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What Does the Machine Tool Industry Need Most?

By P. F. Joseph

MOST of the developments in machine tools have been the result of close association with the men in the large production shops, which is as it should be. Obviously, in building metal working equipment, the need must be first located and then filled. Strange as it may seem, however, some of the advances were literally forced upon the machine tool builders. Where the machine tool builders have been unable to or refused to satisfy his equipment needs, the production man has either designed and built his own machine tool or he has had some small jobbing shop do so for him, with the result that we have today machine tool builders who were forced into the field because the old line builders did not have vision enough to see the possibilities in the new ideas when the production shop men called their attention to the necessity for changes in methods involving designs. The principal cause back of these conditions is the fact that machine tool designers did not expose themselves to the actual production needs by spending time in and around large production shops, where the necessity for changes and newer methods are born, and thus become infected with the necessity for newer methods and devices to incorporate into their own lines. By so doing they would have helped to head off the necessity for the production man going to some small job shop to have his idea perfected—a step that often brings into being a new machine tool shop.

If one were to suggest to some leading machine tool manager that he should place his engineering staff, when he is designing a new production tool, in the city where this kind of production is most plentiful, he would no doubt be looked upon as a fanatic or fool even to think of separating an organization by having the main works in one place and the engineering staff in another. Unfortunately, the large machine tool building centers do not have any high production shops in their cities, which means that to become infected the engineer must buy a railroad ticket to the place where the disease of high production is epidemic. A machine tool designer should be compelled to spend at least four months of each year in the field where his branch of the production prevails in order to be there ready to be infected when the conditions are right. There is another unfortunate condition that has prevailed, and does so still, if the engineer is the principal owner of the business, or is a relative, or connected with the company in such a way that he feels the industry looks to him and him alone for all the advancement in his chosen art. He is very apt to believe that all ideas should and must generate from the end of his own whiskers or he will have failed, which results in so much self sufficiency that he will accept ideas from no one and literally chops the heads off his men by refusing to permit them to incorporate their ideas into the newer design. This environment has provided not a few machine tool builders with competition that would have been avoided had they given the new competitor an opportunity for expression when he was a part of their organization.

Just recently an old line machine tool builder read in the morning paper that he had a new competitor with a very attractive machine well covered by patents.

> If all machine tool designers could spend at least four months in the year in the production centers they would certainly pick up many ideas for improvement of their respective products. And this statement is by no means limited to machine tool designers. It applies with equal force to designers of all kinds of production machinery. Fortunately, some of the bad practices mentioned no longer prevail as a general thing

After making an investigation he felt that his own organization had failed him and said so in no uncertain tones. The men in this organization had nothing to say because they had been humiliated by having their ideas rejected. They were used only from their necks down, the usual situation in a one-man institution.

This organization is watched carefully by its competitors and at the slightest show of discontent on the part of one of its men they will go after him. So far, almost to a man, those leaving the concern have made good in the new environment because they have been permitted to use their heads, which were full to the point of bursting with good new ideas.

One manager, who is of the type mentioned, has inherited an efficient organization in which the key men are full of new ideas. In conference this manager will give way and appear to accept some one else's idea, but after the conference he will discuss the new idea with each of the conferees separately and absolutely talk them out of it. This company has three competitors started by men who were in the organization and became disgruntled because they were not permitted to incorporate their ideas into the designs of machines or the policy of the business.

To Illustrate the Contention

Let us now look back a little and see if the conclusion that the machine tool industry needs vision and infection is true. Before the present method of feeding was used in a planer or shaper a trigger gear was used for this purpose. This was an internal ratchet with small notches or teeth in a blind-end hole. These teeth could not be milled so had to be made by other means, being accomplished by what was then called a drift, which was forced into the piece under an ordinary hydraulic press. Tool post wrenches with square holes were also produced in the same manner, using a square drift instead of a round one.

These and similar operations with shaped drifts, as they were then called, were used in many machine tool shops. It remained for Lapointe to have the vision and become infected with the modern broach idea, through which a very profitable business and a new art, so-called, were established. The hydraulic press manufacturer and the planer and shaper builders were lulled to sleep in contentment with their own line of machinery.

Keyways in gears and the like were chipped with a chisel and hammer, and cut on a shaper or planer for many years. Then some fertile mentality exposed itself to infection and the disease was a keyway-cutting machine of the Baker type. This mentality was in turn lulled into self sufficiency and saw the broach develop.

One bright morning a clever mechanic gave to the market an attachment to place on the cross rail of a planer for milling instead of planing. Not having been exposed to infection, the planer manufacturers rejected this idea because they lacked the vision to see in the not far distant future the planer-type milling machine with its eight or ten milling cutters all working at the same time. The planer-type milling machine has limited the field of expression of planers to a very great extent, and all because planers were designed by engineers who knew planers and would not expose themselves to production shops sufficiently to become infected with the planer-type-of-milling-machine idea.

There is no logical reason why a manufacturer of hole-drilling machinery should not produce a tapping machine, yet at this time there are comparatively few tapping machines built by recognized drill press manufacturers. I do not refer to attachments.

Some time ago the management of a large production shop, having a lot of holes to drill where there were many holes in the same piece, tried to have some machine tool builder produce a machine for this purpose. They failed to interest any of the old line companies and set about to design their own machines. They developed a machine which has fixed centers for the holes to suit or match their peculiar design and are still using some of these original machines. The man responsible for this design started a shop of his own producing multiple-spindle drilling machines of this type and later developed the adjustable spindle.

Some years ago in an agricultural shop, where there was a large battery of nut-tapping machines, a master mechanic made an attachment to one of these machines to tap nuts continuously without the necessity of changing the taps when they filled up with nuts. The attachment, which used a bent tap, was shown to a number of tapping machine manufacturers and several drill manufacturers but none of them had vision enough to see its possibilities, so the idea remained dormant until recently an automatic nut-tapping machine using a bent tap was placed on the market with such success that bent taps are regularly cataloged by the leading tap makers. Yet there is only one bent tap tapper and it is produced by a company that does not make drilling machinery.

Gears are produced in large quantities by hobbing, which is a milling method, but with one exception gear cutters of the hobbing type are not produced by companies who have made a specialty of milling machines.

The Matter of Ground Gears

Along with the gear-cutting machines came a need for means of producing a more accurate hardened gear. Among grinding machines on the market there was nothing available to produce a ground gear tooth. Gear tooth grinding is a branch of the grinding art but, strange again, grinding machine manufacturers do not build gear tooth grinders. Thus another expansion of the machine tool industry came from the introduction of a new application of an old principle in grinding, which was conceived in the production shops in the automobile fields and passed up by the grinding machine builder, although rightfully it is a branch of his chosen art.

Another interesting thing about grinding machines is that a milling machine company had to build a cutter and tool grinder because there was none on the market produced by grinding machine builders. Naturally it did not care to refer to a competitor in milling machines for a cutter grinder. Today one or two of the grinding machine builders have cutter grinders but they did not have vision enough to place them on the market when the milling machine was new.

Similar instances could be cited indefinitely but sufficient has been said to substantiate the statement that what the machine tool industry needs most is vision and an exposure to more infection with the needs of the users of machine tools.

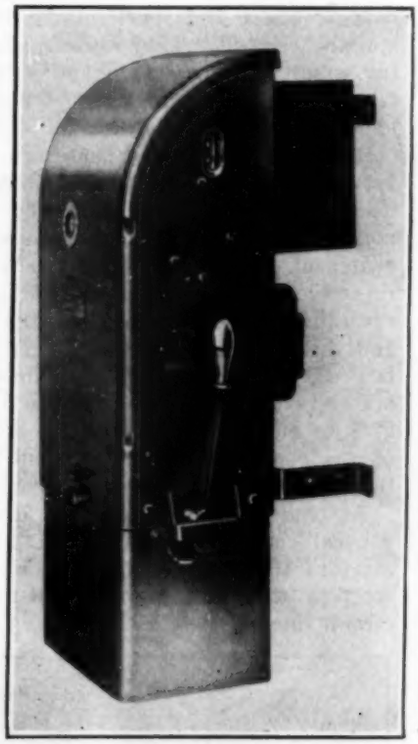
Producers of the master tools of industry should become masters of the master tools of industry and in so doing be pacemakers more than they have been in the past.

Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
Electrical Engineer, Niles-Bement-Pond Co.

Characteristics of manual resistor- and compensator-type starters for a.c. motors—Selection of types of automatic starters—Construction and operation of push-button control stations—Reversing-service controls

THE usual form of manually-operated starter used with squirrel-cage induction motors has some provision for reducing the starting current either by inserting a resistor in series with the primary leads or by the use of a transformer to secure a voltage lower than line voltage to start the motor. Such a starter usually is fully inclosed and provides both undervoltage and overload protection. The resistor-type starter is the simpler of the two, and it is believed that it is preferable where manual starters are required. The motor is connected to the line with resistors in series with the starter leads, which are short-circuited after the motor has come to speed by a movement of the starting handle. The contacts are made and broken in air, and the motor is connected to the line at all times during acceleration. Such a controller is cheap, compact, and easy to maintain. It has the disadvantage of drawing a larger starting current from the line for a given amount of starting torque than the auto-transformer or compensator type, but this current has a higher power factor, which counterbalances at least in part, for the current advantage of the compensator. It is believed that the resistor type of controller is suitable for use with the majority of machines.



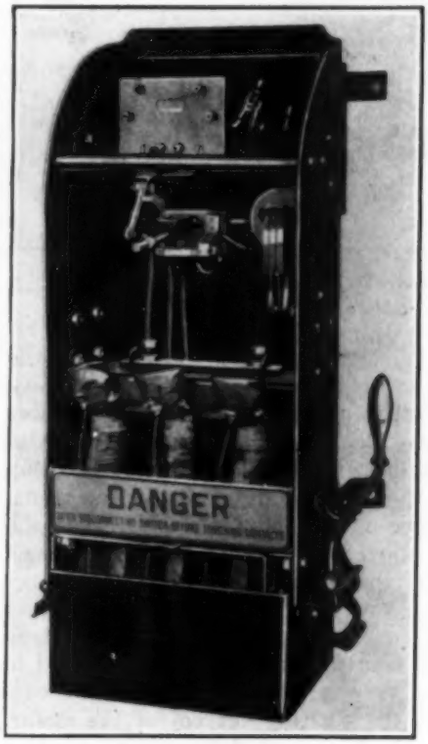


Fig. 35—Manual compensator starter. Fig. 36—Interior view

There is one type of resistor-type starter having a resistor made up of a number of carbon disks which are mechanically compressed to decrease the amount of resistance. Acceleration with this type of control is very smooth, and the starting current may be held to the minimum that will accelerate the motor. It is possible to start an a.c. squirrel-cage induction motor using a starter of this type without the starting current exceeding the full current of the motor. Resistor-type drum controllers are also obtainable, but as these cost nearly as much as other types of starters, and in addition do not provide either overload or undervoltage protection, it is believed that they are advantageous only in cases where a reversing equipment is necessary. For this service, they are cheaper than the other types.

A manual compensator consists primarily of an auto-transformer, usually with taps to make it possible to adjust the output voltage, for starting the motor by applying a reduced voltage to its terminals. The transformer is first connected across the line and the motor terminals to the proper taps on the transformer coils, then, after the motor has come up to speed, the transformer and motor are both disconnected and the motor is connected directly to the line. Such a compensator is shown in Figs. 35 and 36. The three transformer coils can be very clearly seen in Fig. 36, just above

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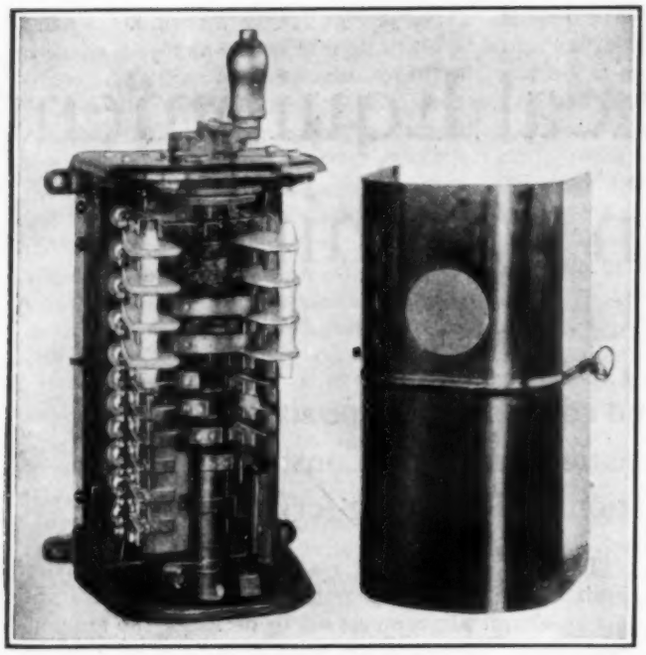
The fifth article. The sixth will appear in an early issue.



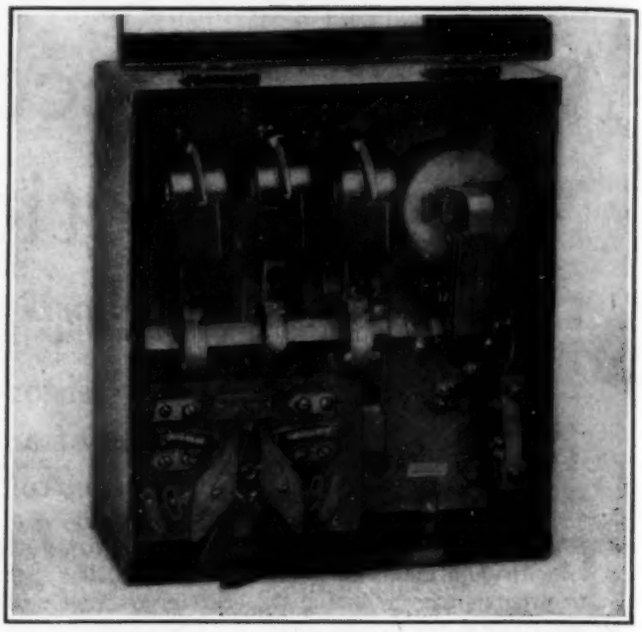


Fig. 37—Drum controller. *Fig. 39—Automatic switch with thermal overload relay*

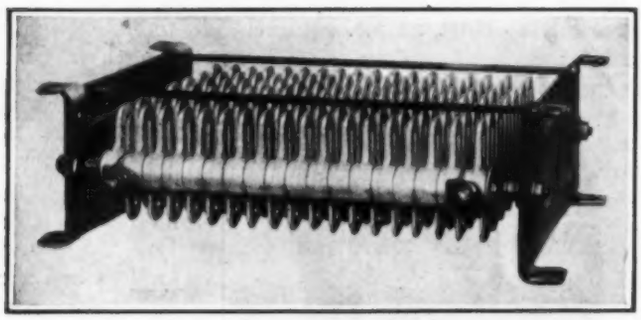


Fig. 38—Secondary resistor for use with drum controller

the danger sign. The contacts, which are closed by the handle on the right of the cabinet, make and break the circuits under oil in a tank, which forms the lower part of the cabinet. The thermal overload relay is at the top of the cabinet, while the undervoltage relay may be seen near the right-hand side above the transformer coils. There is an interlock to prevent the motor from being started direct with full line voltage.

The compensator type of starter has two very heavy inrushes of current, both of which may be larger than the corresponding current peaks of a resistance-type starter. When the transformers are first connected to the line, there is a very large inrush of exciting current in addition to the starting current of the motor. Also, when the motor is connected directly to the line after having been disconnected from the transformer, there is a strong possibility that the line current will be out of phase with the rotating field of the motor induced by the still revolving rotor, with the result that a very heavy current inrush again occurs. This inrush may be larger than the short-circuit current of the motor. By starting with a compensator, a reversing stress is placed on the coils of the motor that is much more injurous than the stress, continued in one direction, caused by the resistance type of starter. Manually-operated compensators are usually provided with overload and undervoltage protection, and the contacts are made and broken under oil. Compensator-type starters are used particularly with large squirrel-cage induction motors, where it is particularly desirable to have low starting current. They are also desirable where starting conditions are severe and a large starting torque is required, or where the motor requires a relatively long time to come to speed.

Reversing manual compensators are not on the market as standard apparatus. Should it be desired to use a compensator for reversing service, a standard non-reversing starter may be used with a reversing switch of the knife or drum type in the line leads. To reverse the motor, the starter is first tripped, the reversing switch thrown to the opposite direction, and the motor again started. If this type of control is used, the motor should be allowed to come to a stop before being started in a reverse direction. It is desirable to run the circuit of the undervoltage trip coil of the compensator through the reversing switch, so that its operation will trip the compensator.

Automatic starters may be divided into the same general classes as the manual starters: they include starters that connect the motor directly to the line; starters that introduce a resistor into the primary circuit during the starting period and that later short-

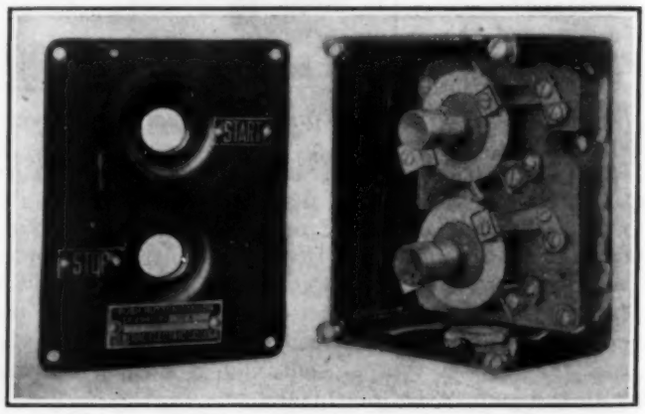


Fig. 41—Heavy-duty, push-button switch

circuit this resistor after the motor has come to speed; starters that apply a reduced voltage from an auto-transformer to start the motor from rest and apply full voltage for the running cycle; and starters for slip-ring motors that connect the primary to the line with resistance connected in the secondary circuit, which resistance is short-circuited to bring the motor to speed. The standard controllers of these types are usually non-reversing, with the exception of the first or "across-the-line" type, which is now carried in stock for reversing service. The primary-resistor type and secondary-resistor type may be obtained for reversing service, but when so used they are special, and must be built to order. The compensator type is not used for reversing service, except that, very occasionally, the line leads may be carried through a reversing switch, which is used in connection with a simple non-reversing automatic compensator. This combination is not recommended, unless the motor is to be reversed infrequently.

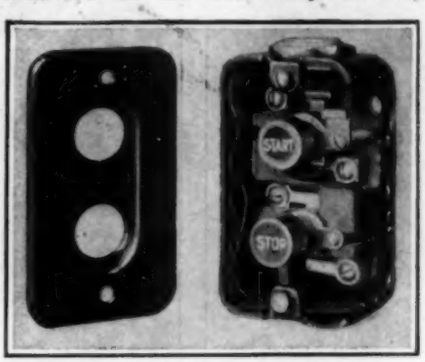


Fig. 40—Construction of a two-station, push-button switch

Drum controllers are extensively used for controlling slip-ring induction motors, particularly where reversing service is desirable. Such controllers are simple and rugged, as may be seen from the drum shown in Fig. 37. Such a drum connects the primary leads of the motor to the line, and gradually short-circuits the secondary resistor, which may be open, as shown in Fig. 38, or may have a mesh cover, as is preferable. A drum of this sort interlocks the primary and secondary circuits, so that it is impossible to start the motor without the secondary resistor in circuit. However, it provides neither undervoltage nor overload protection, so that it is advisable to add to the equipment a magnetic protective panel which is closed by the first movement of the drum controller from the "off" position.

Automatic starters that connect a motor directly to the line may or may not give overload and undervoltage protection. On machine tools, a starter should be used that gives both, as the additional cost is small in comparison with the protection afforded. Undervoltage protection is obtained by use of a so-called three-wire master switch. The ordinary "start-and-stop" push button is of this type. By means of such a station the magnet coil of the line contactor is connected directly to the line only at starting. The closing of the contactor closes an auxiliary contact, which completes another circuit to the magnet coil, through the contacts of the "stop" button, or its equivalent. The "start" push-button contacts return to a normally open position as soon as released, and the contactor is held closed by the circuit through the stop button. When this is pressed, the contactor is tripped and the circuit opened. As the operating circuit is also opened by the auxiliary contact, which is in turn opened by the opening of the contactor, the contactor is not restored by returning the contacts of the stop button to their normally closed position.

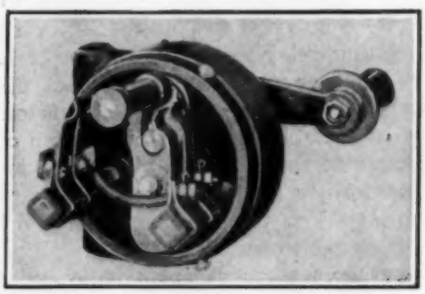


Fig. 43—Drum-type master switch for use with reversing automatic controller

A single button, whether operated by hand or through a spline shaft, cannot give undervoltage protection with the ordinary starter. Should spline shaft operation be desired, a special master switch, designed to provide undervoltage protection, and having a starting finger that does not make contact at the running position, should be used. Overload protection is obtained by means of thermal cut-outs for small motors and thermal relays for the larger motors. They are cheaper than the plunger relay with series coil and dash pot, and are very satisfactory in service. After functioning, most thermal relays must be manually restored. A starter of this type is shown in Fig. 39, with a thermal overload relay at the lower left-hand side of the panel. The three-pole contactor, shown in the upper part of the cabinet, is closed by the magnet coil and armature at the right. Each contact has an arc chute, which confines the arc, cools it, and prevents it from jumping to a terminal of opposite polarity. The overload relay, with overload elements in two lines, may be seen just below the contactor.

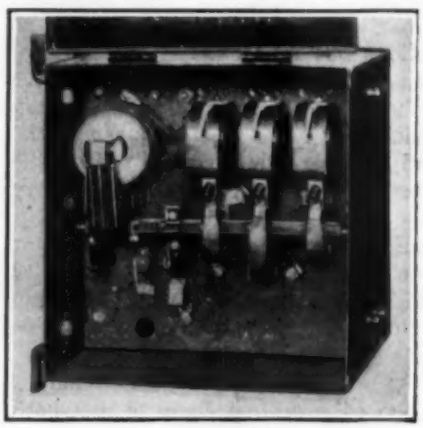
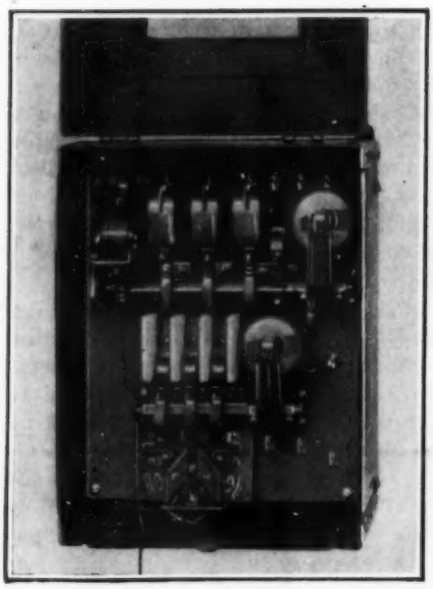


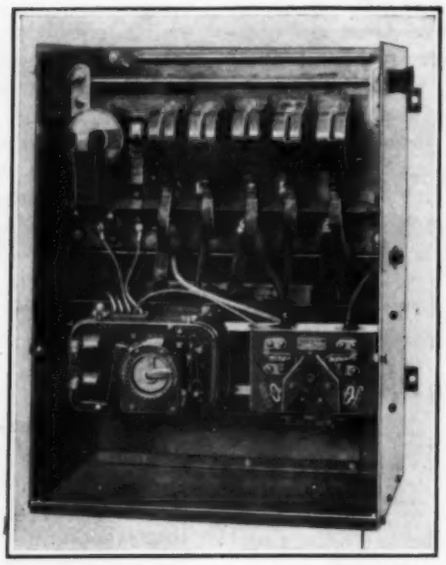
Fig. 42—Automatic reversing switch

These starters are very satisfactory for use with small a.c. polyphase motors, 5 hp. and under, single-phase motors, 3 hp. and under, high-resistance rotor squirrel-cage motors of any horsepower, or motors having a starting winding for limiting the starting current. Motors of this last class include those motors having a centrifugal starting switch built into the motor, and those having double squirrel-cage windings.

The thermal overload relay opens the control circuit of the line contactors, and so disconnects the motor from the line in case of overload. This relay will open on a slight overload long continued or will operate almost instantly on heavy overloads.

In Fig. 40 is shown the internal construction of the push button ordinarily furnished with a starter of this sort. The start push button, when depressed, closes a small spring contact, while the stop button, when depressed, opens a similar contact. When pressure is removed from a button, spring pressure returns it to its normal position. The type of button here shown is satisfactory for those installations in which the motor is infrequently started. The button shown in Fig. 41





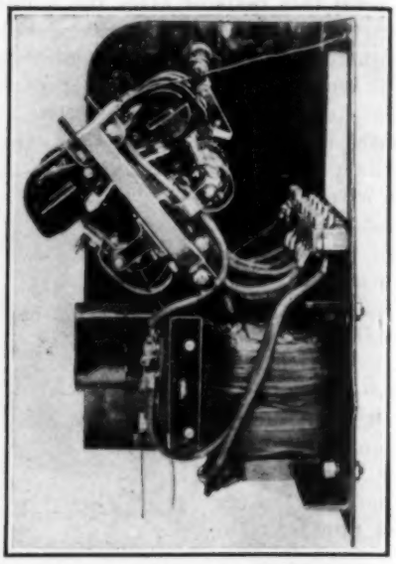


Fig. 44—Controls for primary-resistor type automatic starter. Fig. 45—Automatic compensator-type starter Fig. 46—Sectional view

is much more rugged in construction and is preferable where there are many operations, or where the button must break a relatively large current.

This type of starter may also be obtained for reversing service, as shown in Fig. 42. This reversing controller is used particularly with traverse motors, and similar applications but it is entirely satisfactory for use with any a.c. motor that it is permissible to throw directly on the line. The limitation of horsepower of motors which may be so started is set by the power company, and is intended solely to reduce the amount of disturbance in the lines caused by the heavy current inrush.

The reversing panel shown has one line contactor mounted on each side of the panel and is provided with a mechanical interlock to prevent both contacts being closed at the same time. The interlocking bar may be seen passing through the panel just under the magnet coil. The overload relay is on the opposite side of the panel. Both sides of the cabinet open, so that both contactors are readily accessible. For operating a reversing panel, a three-button "start," "stop" and "reverse" push button, should be used. Where it is desirable to operate a reversing panel by a master switch which may be geared or coupled to some part of the machine, a small drum, such as is shown in Fig. 43 may be used, but it should be remembered that a drum master switch of this sort does not give undervoltage protection when used with the ordinary panel.

The majority of induction motors use a starter that limits the starting current and thus lessens the disturbance on the line caused by starting the motor. These are similar in type to the manual starters, except that they accomplish the same functions by magnetic contactors. The resistance type is simpler and cheaper than the compensator type, and is better adapted for equipments requiring frequent starting or jogging of the motor. The compensator type is particularly applicable for machines having great inertia, and requiring relatively large starting torque for an extended period, and where large starting currents are objectionable.

Either resistor or compensator type of starter, as usually built, will give overload protection and usually will give undervoltage protection when used with a proper master switch, such as a two-button, three-wire push button.

The resistance type of starter tends to give smoother acceleration, as the drop across the resistor decreases as the motor comes up to speed, thus gradually increasing the voltage across the motor terminals. When the motor is connected directly to the line, the circuit between line and motor is not opened, as is usual in a compensator-type starter, since the motor is brought up to final speed by short-circuiting the series resistors. Fig. 44 shows a simple and reliable form of primary-resistor type automatic starter. The contactor at the top of the panel connects the motor to the line through resistors mounted on the back of the panel which are short-circuited after a predetermined time by the contactor at the center of the panel. The time interval which may be adjusted is obtained through an ingenious adjustable relay at the upper left-hand side of the panel, while the thermal overload relay at the bottom provides overload protection. The same type of push buttons are used as with the automatic, across-the-line starter.

The automatic compensator-type starter is somewhat more elaborate, as is seen from Figs. 45 and 46. In this case it consists of two mechanically-interlocked magnetic contactors mounted back to back; a thermal overload relay shown at the lower right of the panel; a timing relay shown at the lower left; and an autotransformer which is located back of the relays. This starter, when the start push button is first pressed, closes the starting contactor, which connects the transformer to the line, and also connects the motor to the transformer in such a way that a reduced voltage is impressed on the motor. After a definite time, which may be set to suit conditions by adjustment of the timing relay, the transformer is disconnected from the line, the motor from the transformer and the motor connected directly to the line.

To say it with flowers is fine if you know what you want to talk about, but be sure your meaning is not misinterpreted. Likewise, when you give an order in the shop, say it so your meaning is understood clearly and thus avoid an embarrassing explanation.

Automotive Production

How Lycoming Makes Cylinder Blocks for Auto Engines

These illustrations from the Lycoming Manufacturing Co., Williamsport, Pa., show an eight-cylinder block in its various stages of manufacture

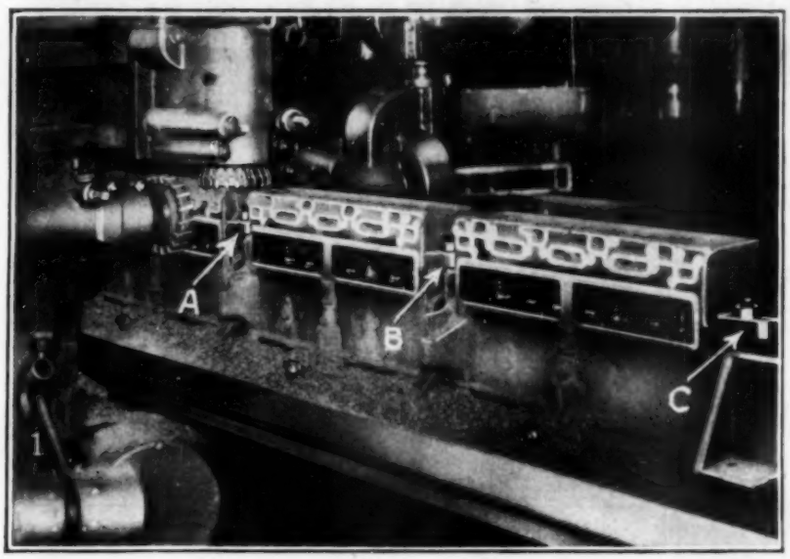
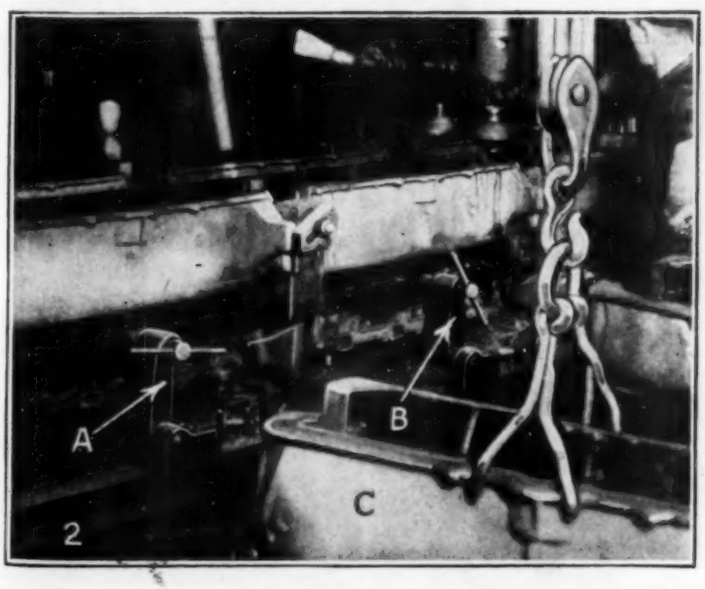


Fig. 1—Milling top and two sides of block. Supports and clamps are shown at *A*, *B* and *C*

Fig. 2—Milling crankcase joint for oil pan. Two strings are milled at once. Side clamps *A* and *B* swing down out of the way. Case at *C* ready to swing into place



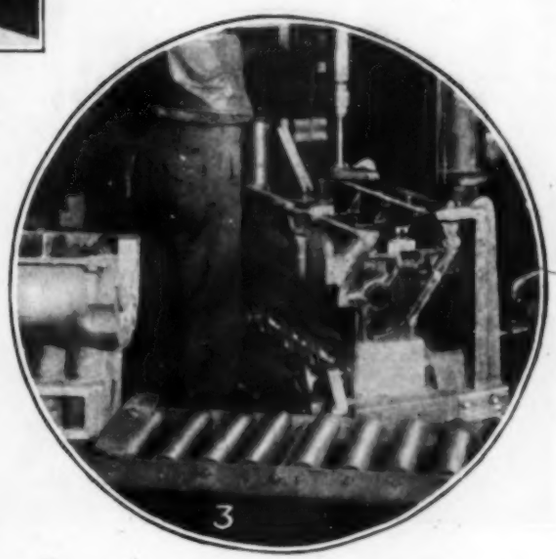


Fig. 3—Special ¾-in. locating holes are drilled at end of one crankcase flange for locating block in future operations. Note conveyors

Automotive Production

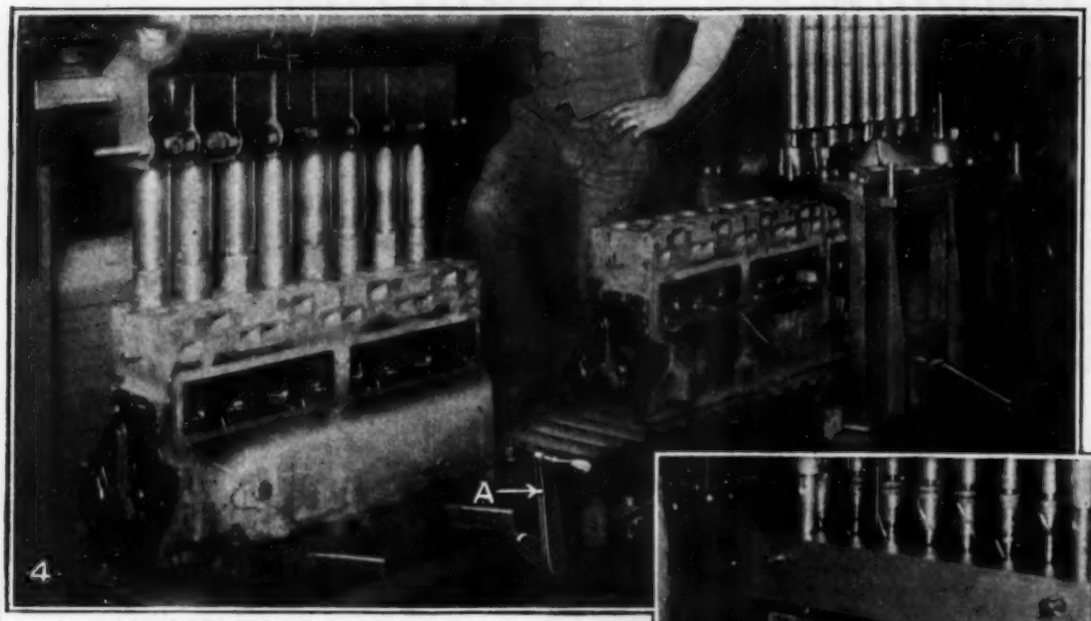


Fig. 4—Rough boring cylinder bores at left, and fly-cutting at right. The last reamed operation trues the bores for final reaming and honing. Locating dowels operated by lever *A*. Conveyor between machines

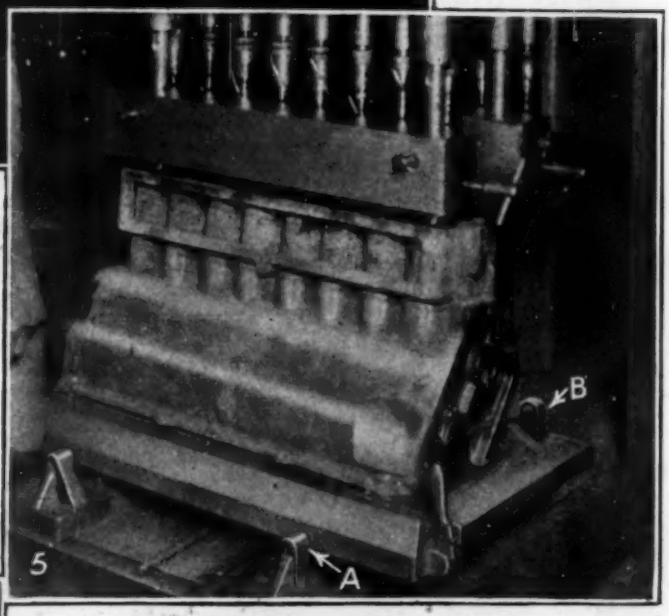
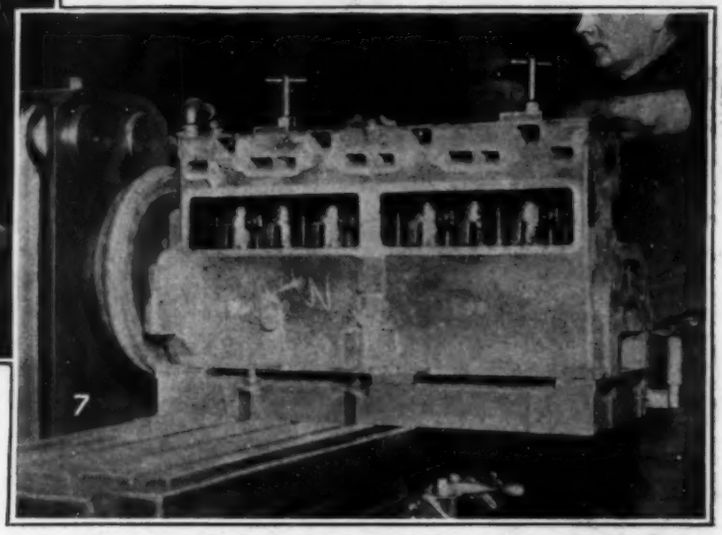


Fig. 5—Boring valve throats with two sets of spindles. Fixture located in two positions by stops *A* and *B*

Fig. 6—Drilling and reaming valve-stem holes. Drill guide *A* located by cylinder bores

Fig. 7—Milling front end of block on knee type machine



Automotive Production

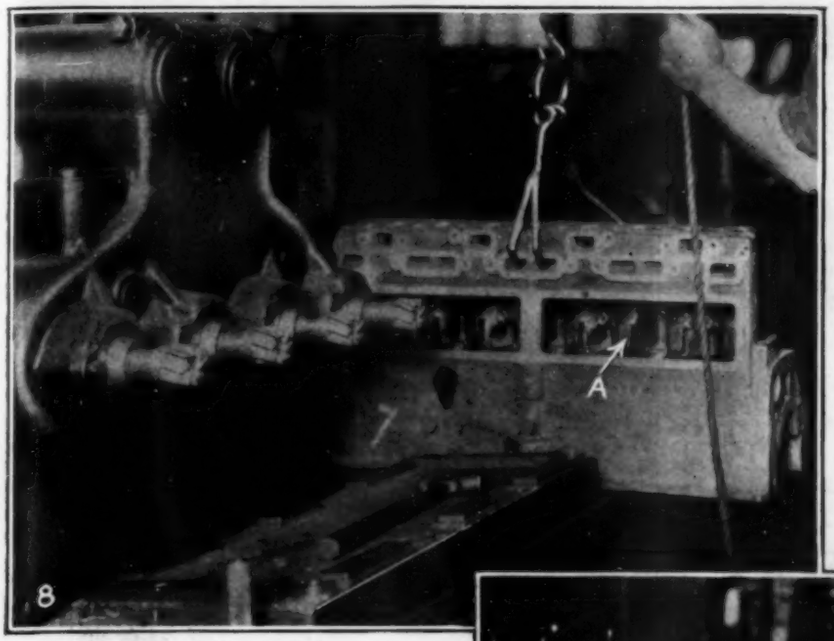


Fig. 8—Milling valve-tappet guide bosses *A* with 4-spindle attachment on Milwaukee machine. Valve-tappet guides are made in groups and bolt in place

Fig. 9—Boring crank- and camshaft bearings on special fixtures on Rockford machine. The back fixture is for rough boring, the front for finishing. Locating dowel shown at *A*. Fly cutters are used for finishing

Fig. 11—Boring for timing- and pump gears, blocks located in fixture by dowels, and plugs in crankshaft hole as at *A*. Block is raised in position by lever *B*

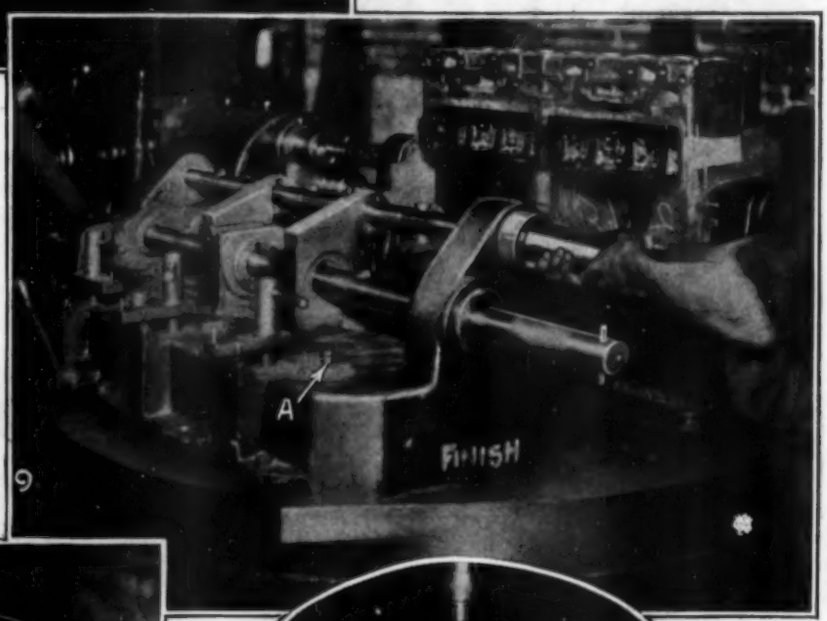
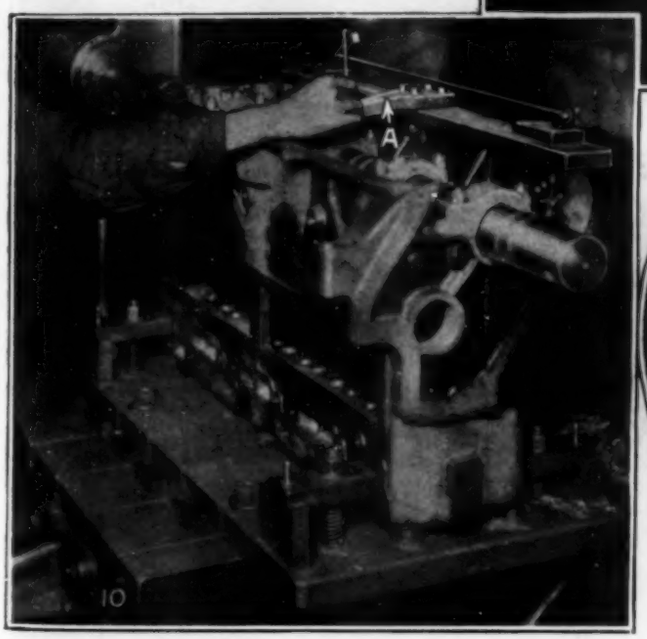
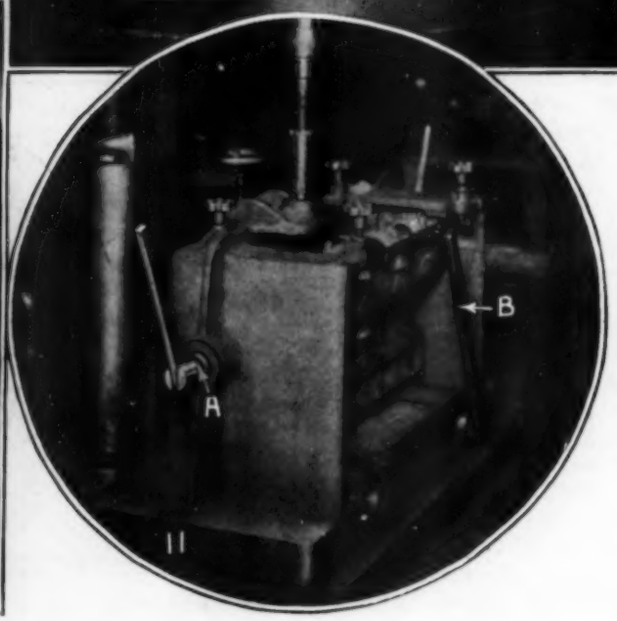


Fig. 10—Facing ends of bearings on Lucas boring machine with fly cutter in bar. Center bearing takes thrust. Gage *A*, located from dowel holes, shows proper length and location of bearing





Automotive Production

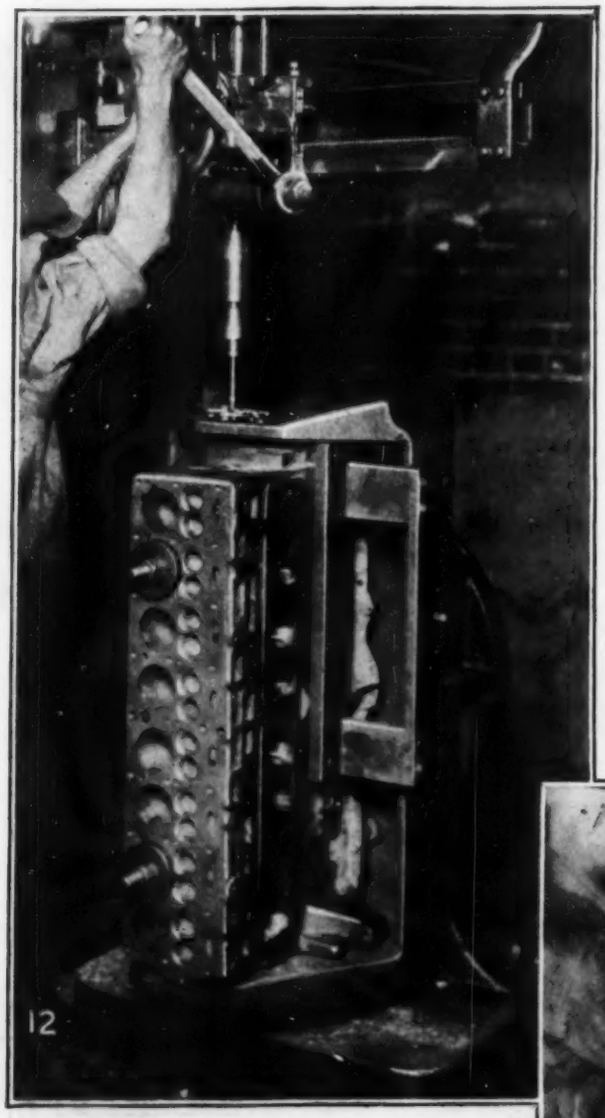
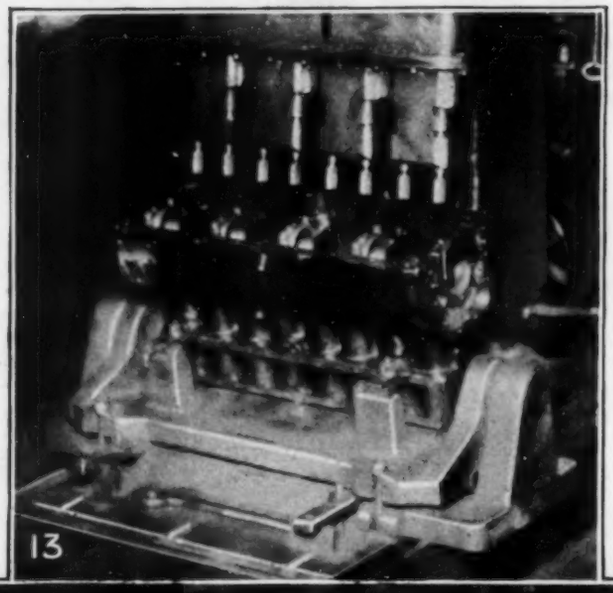


Fig. 12—Drilling end and side holes in a revolving fixture under a Carlton radial

Fig. 13—Fixture and special milling head for cutting connecting-rod clearance in lower ends of cylinder bores. Fixture rocks in two positions to reach each side of bore



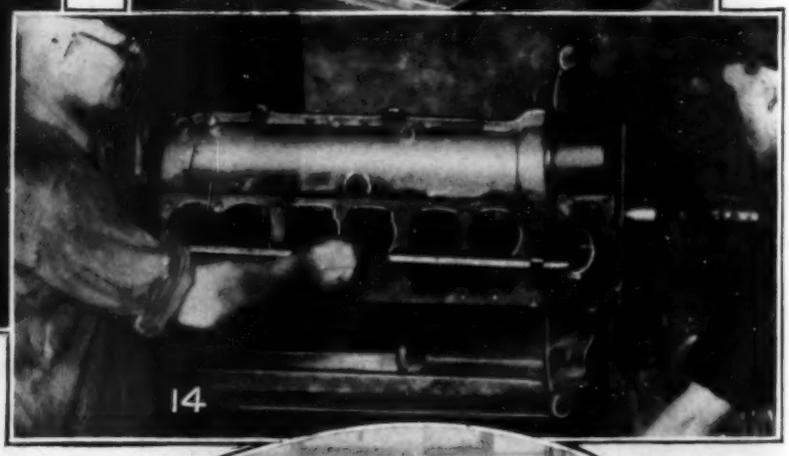


Fig. 14—Boring and facing bell housing in lathe. Block swings on mandrel. Double tool used. Gage for depth being held in place

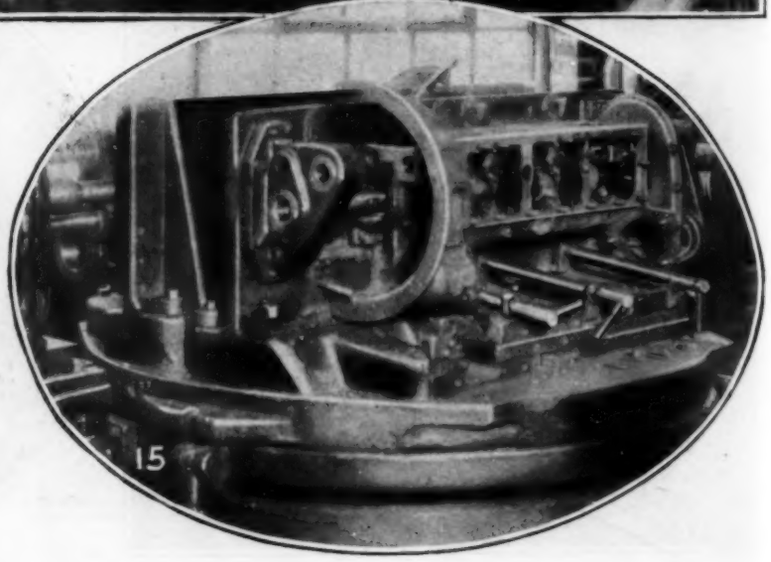
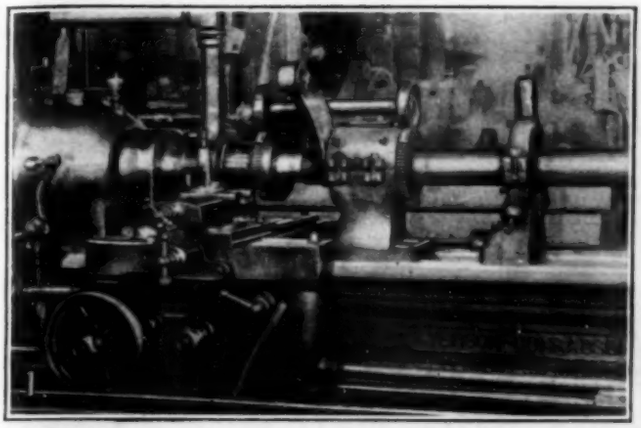


Fig. 15—Final boring of shaft bearings with a fly cutter. This is done just before assembly so as to secure the best alignment possible



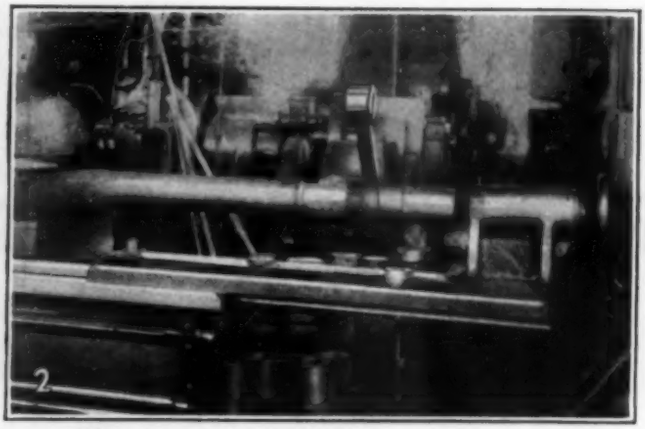


Fig. 1—Tumbling-shaft set-up, with both end- and center-bearing turning tools in place
Fig. 2—Tailstock end of tumbling-shaft set-up

Time-Savers on the Oregon Short Line

By L. C. MORROW
Managing Editor, American Machinist

Two tools for turning tumbling-shaft bearings—Racks for tumbling-shafts and links—Cutting-out parts with the torch—A gage for checking crankpin quartering

TUMBLING shaft difficulties, both in machining and handling, are overcome in the shops of the Oregon Short Line of the Union Pacific System, at Pocatello, Idaho, by the devices illustrated in Figs. 1 to 4, inclusive. Center bearings, as shown in Fig. 3, are turned by a tool driven by gears from the end-bearing turning tool. By referring to Fig. 1 it will be seen that the end-turning tool consists of a sleeve mounted on an arbor held in the chuck of the lathe. A center, carried by the arbor, bears in the center-hole of the tumbling shaft. The sleeve travels on the spline key of the arbor. Longitudinal motion is secured by hand or power traverse of the lathe carriage, the power being transmitted through a forked piece held in the tool post and straddling a flange of the sleeve. When the end bearing is being turned, the center-bearing turning tool is not connected, the top portion, carrying the transmission gears, being thrown back as shown in Fig. 3. When turning a center bearing, the end-bearing tool is not moved longitudinally. For purposes of safety the forked piece is withdrawn from the flange. Otherwise the set-up is the same as shown in Figs. 1 and 2, the latter showing how the shaft is supported on an extension tailstock. The cutting tool for center-bearing turning, *A*, is carried in a collar that has a bearing in the upper and lower housings, is connected to a feed screw, and travels longitudinally as well as revolves in the housings, being guided in its longitudinal travel by four pins *B* and being driven by them. The longitudinal travel is controlled by star feed *C*, and the pins which revolve the collar are

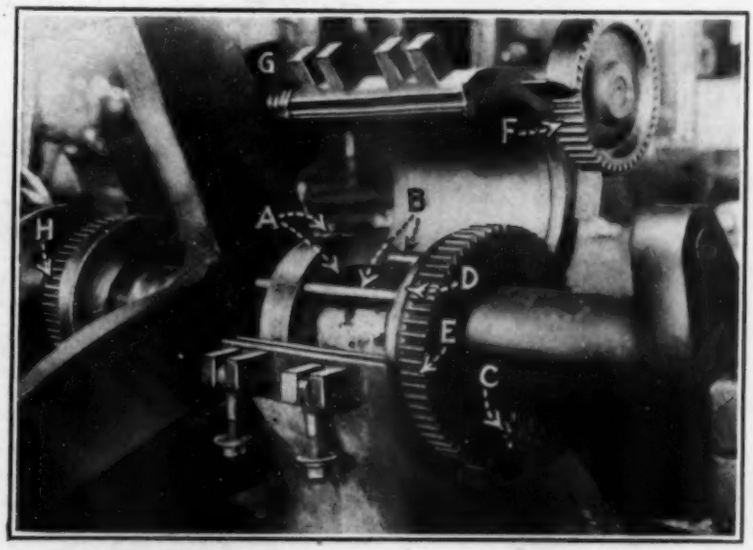


Fig. 3—Device for turning the center bearings of tumbling shafts

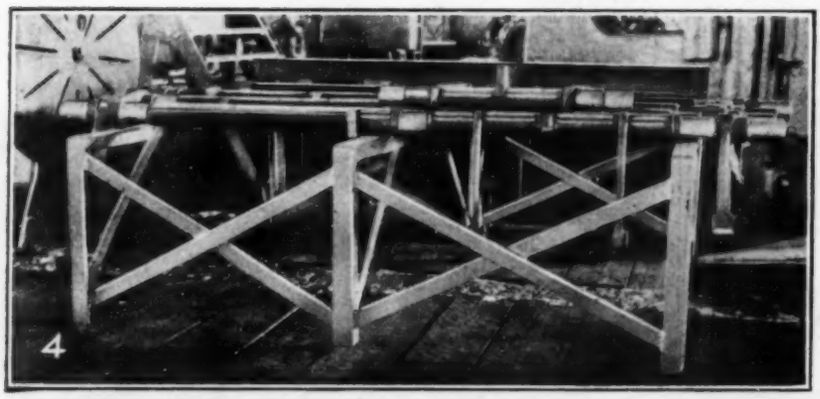


Fig. 4—Tumbling-shaft rack

Fig. 5—Link rack

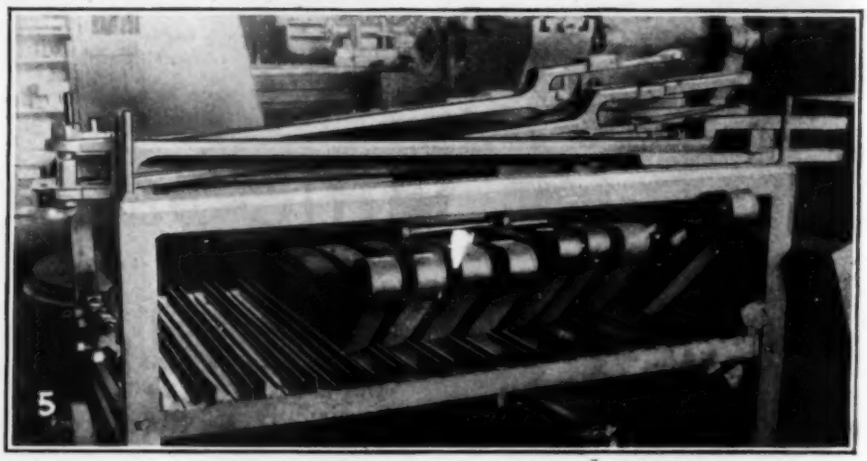


Fig. 6—Pit, whitewashed with acetylene slush

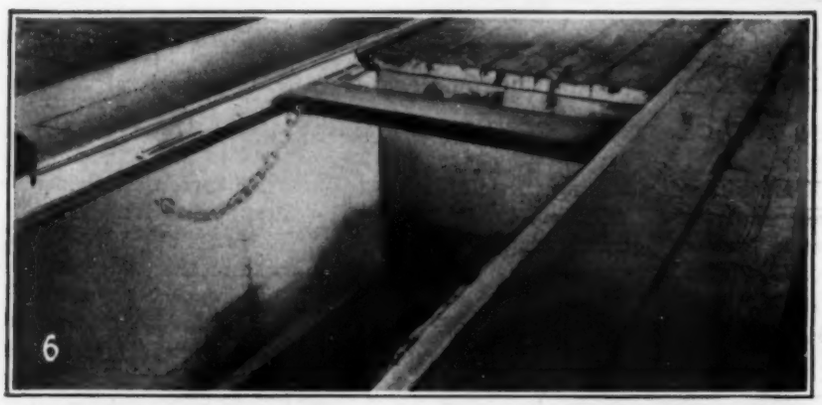
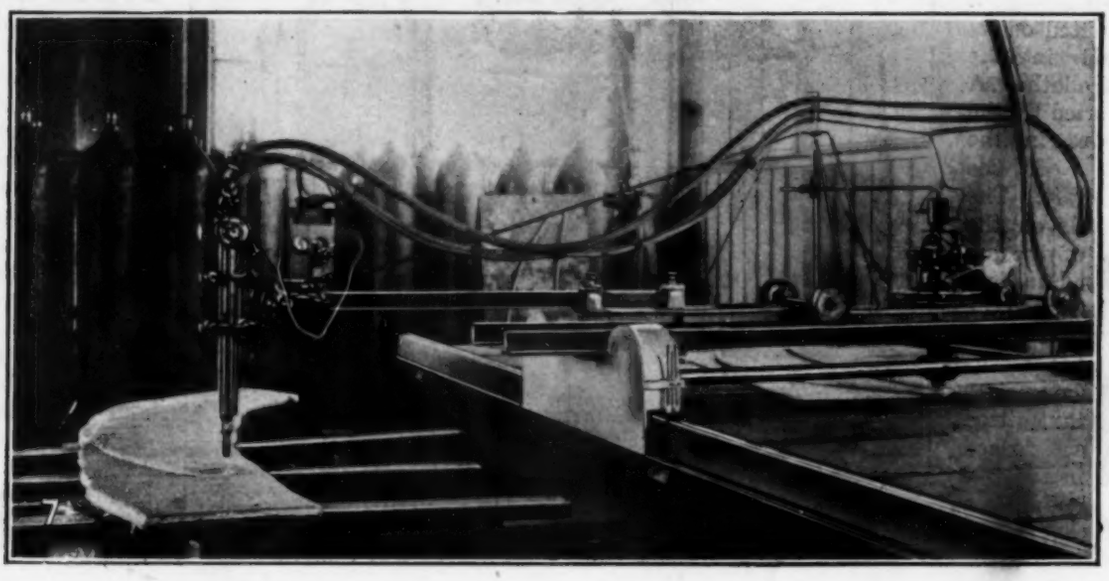
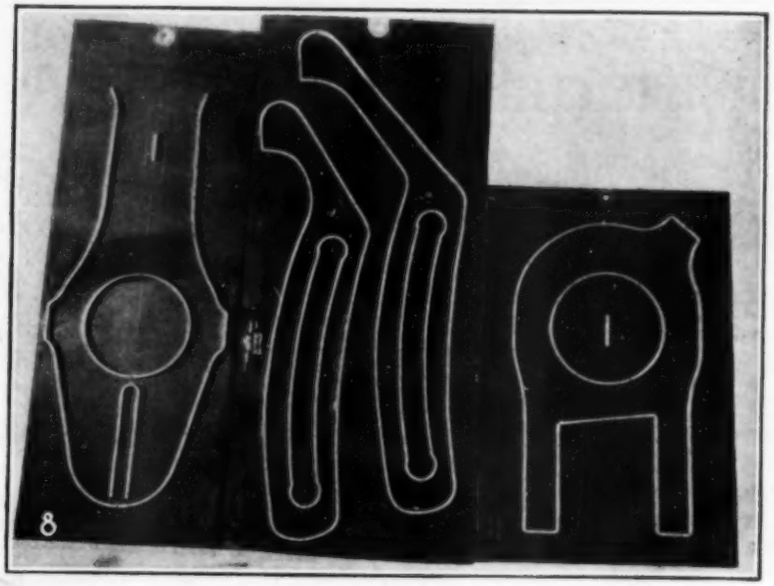


Fig. 7—The automatic oxy-acetylene cutting machine cutting-out a counterbalance weight





Figs. 8, 9, and 10—Templets for oxy-acetylene cutting

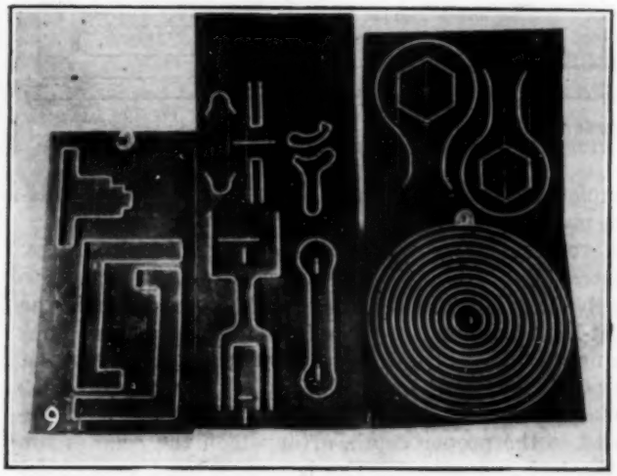
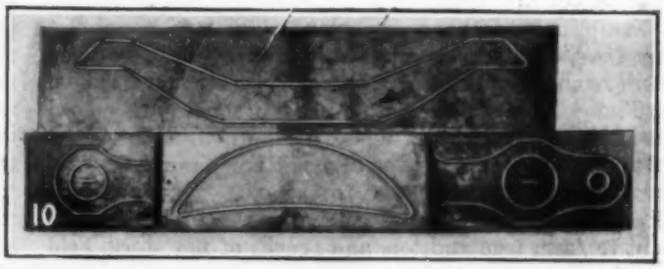
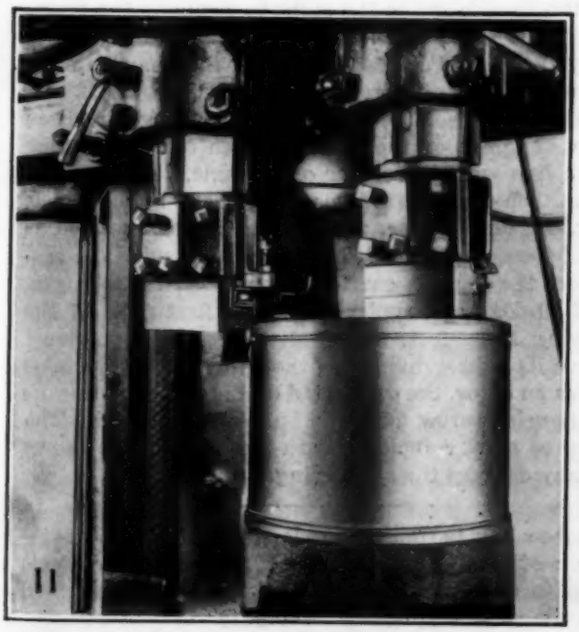


Fig. 11—Tools for forming and cutting-off valve rings

Fig. 12—Crankpin quartering gage





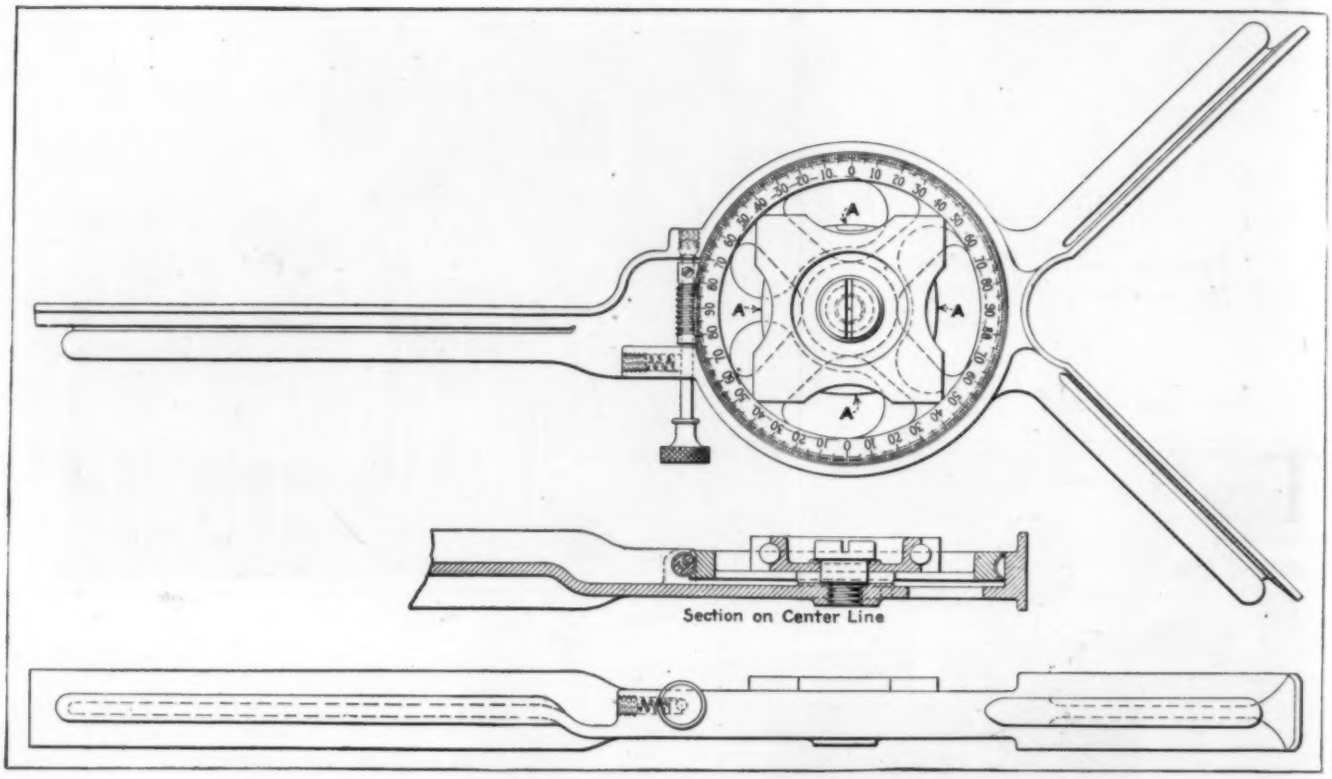


Fig. 13—Crankpin quartering gage

fixed to the plate *D*, attached to the gear *E*. Power to gear *E* is transmitted through the train *F*, *G* and *H*, the gear *H* being attached to the sleeve of the end-bearing turning tool.

Tumbling shafts are awkward things to handle at any time, and are especially difficult to pile. To keep them from spreading all over the floor, the stand shown in Fig. 4 has been built. When the shafts are placed on it, the levers will swing to the bottom, and the top of the pile presents a relatively flat appearance. Moreover, the stand is pleasing to the eye, and makes for cleanliness and orderliness. It consists of angle-irons bent to form legs and top, and braces of flat stock, held together by welded joints.

A similar stand, used for storing links, is illustrated in Fig. 5. The links, instead of being placed on top, are slid into guides on a shelf, leaving the top of the stand available for other parts. The construction of both the link and tumbling-shaft racks is such as to furnish no excuse for the accumulation of dirt, scrap, and rubbish under them.

This matter of clean shop is carried into the pits, which are whitewashed, as shown in Fig. 6, with acetylene slush, a weekly, Sunday operation, performed by a clean-up gang of laborers.

There is no scarcity of slush, as will be gathered from an observation of the many parts, Figs. 8, 9 and 10, cut out on the automatic oxy-acetylene cutting machine, Fig. 7, shown at work on a counterbalance weight for a driving wheel. The parts shown include reverse links, back-end main-rod adapters, middle connection side-rod ends, chuck jaws for milling shoes and wedges, engine-truck jaws, miscellaneous parts, spanner wrenches, circles, transmission bar hangers, truck equalizers, counterbalance weights, and link rods. There are many more templets in the cutting room. Templets are made of aluminum strips riveted to sheet-iron plates.

A very fast operation is the cutting of valve rings, illustrated in Fig. 11. The pot casting is clamped to the boring-mill table, turned and bored. Then the right-hand head is run down inside of the casting until the upper tool is at a depth that will clean up the top of the pot. The head is then fed to the right until the top surface has been faced, and the lower tool has penetrated to the proper depth, after which the head is run to the left and raised. The left-hand head is then set with the bottom of the adjustable, and locked, thumb screw just bearing on the faced top of the pot, after which the head is fed to the right to complete the forming and cutting-off of the ring from the outside.

Many times it is desirable to check the quartering of a pair of drivers. The gage illustrated in Figs. 12 and 13 is used to do so. The first step in making a check is to set the gage on the crankpin with the edge of the blade in line with the center of the axle. The knurled screw is then turned until one of the four bubble levels *A*, Fig. 13, shows true, after which an observation is taken of the degree mark that corresponds with the witness line, the gage is carried around to the other pin, rotated 90 deg., and applied as on the first pin. If the quartering is perfect, the level that comes uppermost will have its bubble divided by the hair line. If the level indicates an error, the graduated dial is turned by means of the knurled screw until the bubble is centered. The new degree mark coinciding with the witness line shows how many degrees the quartering is in error.

Just how far hardness and long wearing life go together is still a problem. Some of the new gage steels are said to give a longer life when they can be touched with a file than when glass hard.

Abstracts of Automotive Papers

These papers were presented January 25 to 28 at the annual meeting of the Society of Automotive Engineers, in Detroit

Industrial Application of X-Rays

By George L. Clark, Robert H. Aborn and Elmer W. Brugmann
Department of Chemical Engineering, Massachusetts Institute of Technology

THE newest phase of the thirty-one year old science of X-rays is the application to the practical problems of industry. This radiation now constitutes a most promising tool, and because the automotive industry is concerned with so many different kinds of materials, it is a field for the service of this new tool which previously had only medical applications.

X-rays are electromagnetic vibrations similar to ordinary visible light, except that the average wave length is only about 1/6,000 as great as yellow light. In the electromagnetic spectrum are to be found several types of radiation all of which are fundamentally alike except in wave length.

Since their wave lengths are so much shorter, or their frequencies greater, X-rays may be expected to penetrate materials which are opaque to light, and to be intimately related to a far finer subdivision of matter than is possible for light waves. Even under the ultra-microscope the examination of matter with the aid of visible light rays can reach only a definite limit of size, and with the ultraviolet microscope a limit is reached. Beyond this, X-rays are able to take the investigator on to the molecules and atoms, even to the planetary universe within the atom.

The essential parts of an X-ray generating apparatus are: A source of electrons proceeding from a cathode (a hot-wire filament in the Coolidge tube), a target or anticathode-ray stream, and a means of applying a potential difference between the cathode and the target which will accelerate the electrons to the requisite velocity during passage across the intervening space.

The application of X-rays to the determination of defects and internal conditions in industrial materials is recent. Extensive radiographic tests on metals have been made at the Watertown Arsenal. There have been almost innumerable miscellaneous applications of radiography in examining finished products.

The defects which are usually revealed by radiographic examination of castings are: Gas cavities, sand inclusions, slag inclusions, pipe cavities, porosity, cracks, and metal segregations.

Many automotive applications of radiography suggest themselves in addition to the great field of castings, and the great service of X-ray in making possible the wide and safe use of castings where forgings are now employed. Armatures in generators, molded insulation around metal parts, small metal tubing, entire carburetors in place which may be functioning unsatisfactorily, all welds, valves, soldered joints, spark plugs, the bonding between cord or fabric and rubber in tires, insulated wire, airplane frames, all these may be examined for interior soundness or for the cause of unsatisfactory behavior without destruction or disassembly of the specimen.

Apprenticeship Needs in the Automotive Industry

By H. A. Frommelt

FREQUENTLY, modern production methods are pointed to as evidence that apprenticeship is unnecessary today. Specialists, machine operators, semi-skilled employees, rather than the trained mechanic, are said to be necessary under modern methods of production and manufacture. In fact, the effect of mass production methods has been to increase the demand for skill and training. More skilled mechanics are required today than ever before, even in the highly specialized industries.

The automotive industry is an example of mass production, and within the industry itself is an army of toolmakers and other mechanics who require the highest kind of skill. It is also a fact that an industry organized as is this one requires a large amount of supervisory personnel trained in the industry. Moreover, the special equipment and machines demanded by the automotive industry has in turn drawn upon the upper levels of skill in the country for their creation and manufacture.

An analysis of the machine department of any automobile manufacturing plant makes evident the following objectives for apprentice training: Semi-skilled operators, maintenance machinists, die makers, tool makers, draftsmen, set-up men, inspectors, production department personnel, time study personnel, engineering department, assistant foremen, foremen.

The fundamental course for all of these is a combination schedule of machine shop and toolroom. All apprentices should be inducted as machinist apprentices; at the end of two years depending upon individual abilities, predilections, and opportunities, some would be shunted into tool-making, some into die-making, some into the drafting room or engineering department to continue as drafting apprentices, while some would continue as machinists. The lower level of

the entire group would come out at the end of four years as semi-skilled operators. A few would continue on in the shop as set-up men, inspectors, assistant foremen, and foremen as the opportunities and their abilities permitted. Hence, while the training program would not in any sense contemplate the "training" of foremen, nevertheless it would be one of the prime functions of such a program to "uncover" such latent talent existing in the shop.

The same analysis should be made for the other departments, such as the heat-treating, body building, foundry and pattern shop. In each of these some young men should be in training, if only for supervisory positions, where a broad trade training is necessary.

But it is in the service branch of the automotive business that we find the greatest need for training. There are at present employed in the United States about 300,000 repairmen and helpers. Ninety thousand of these entered the industry last year, and less than 20,000 had any special training before employment, which means that 70,000 raw recruits were taken into repair shops last year to learn by the error method, which is uneconomical and unjust to clients.

There are now in the country an average of 270 cars in operation to each service station, or about 60 cars to each service mechanic. If this ratio is kept there must be trained each year at least 100,000 men. If the apprenticeship program of the automotive plants were sufficiently wide in scope, a thorough and fundamental mechanical trade course would be included to train service managers. The regular machine shop apprenticeship provides an excellent foundation for this program. Apprenticeship for the most neglected field, namely that of service, rests largely with the impetus of an example set by the manufacturer, in addition to the actual support of such a program.

The Possibilities of Cast Iron

BY E. J. LOWRY

THE gray iron industry has been moving along in research, and many new processes have been uncovered which are leading to the perfection of cast iron. Where 30,000 lb. per sq.in. in tensile strength was formerly considered a strong iron, in some instances 60,000 lb. tensile strength has now been reached.

It is normally supposed that variation of hardness gives a corresponding change to the machinability of irons, but experiments conducted by the author did not prove the theories. The machining was done on a boring mill. The speed was kept at 64 r.p.m., the feed at 137 in. per min., and the cut at 74.88 ft. per min. The amount of metal removed varied, but this was corrected in the final computation. A recording watt-meter was attached to the motor driving the boring mill. The watt-meter was so sensitive that hard spots could be detected as the mill performed its cutting operation. Two cylinder blocks were selected from each cast and the power consumed observed.

The power consumed did not vary with the Brinell hardness or the combined carbon. There does not seem to be any well established relation between these factors. In every case, the charcoal iron mixtures require less power to do the machining operation.

For the wear tests the specimens were placed on a rotating spindle at 630 r.p.m., and were held at constant temperature by water cooling. The specimens were "worn" by a brake shoe of similar material attached to a 3-ft. lever arm carrying a 15-lb. weight at the end. Both the brake shoe and specimen were weighed at definite intervals to show the loss by wear.

There is an appreciable difference in the wear of irons, and little correlation can be seen, either in the direction of hardness or combined carbon. Wear seems to be governed by the carbon forms, and perhaps by the pearlitic formation. The analysis does not appear to be a tangible factor.

It was also expected that the closer the grain, the longer the wear, but the results of the tests were to the contrary. It was found that when a hard casting was worn against a soft piece, a maximum amount of wear occurred in the first 100 hours, but at the end of 1,000 hours the soft piece had worn less than the harder one. The only answer to this is the fact that the soft piece allows a shell to be formed by the slipping of the metal. When the final hardness was taken, after wear had been performed, it had become almost glass-like. A further test showed that when a hard piece was put into friction with a piece of similar hardness, both pieces wore.

From the studies and tests made it was concluded that the price of cast iron governs its purchase, in most instances, and that there is too little authentic information regarding the elements in cast iron. Brinell tests do not actually indicate hardness, combined carbon, wear, or machinability of cast iron, but quality of the raw materials affects these factors.

Development of the General Motors Institute

BY ALBERT SOBEY

Director of Education, Flint Institute of Technology

SUMMARIZING in a sentence the reason for the establishment by the General Motors Corporation of the Institute of Technology at Flint, I would say that it represents a movement on the part of this large corporation to make definite provision for the development of manpower for its world-wide organization to meet its pressing personnel problems.

It is natural that the development of spare time courses of training for employees already at work should come first. The difficulty that presented itself immediately was the differences in the education, experience, and ability of the men who started training in any one particular course. They covered such a wide range as to make effective work on any ordinary group basis almost impossible. To meet this situation it became necessary to emphasize individual instruction.

To meet the needs of the plant not served by this spare-time program, three full-time courses were organized: The service course, the technical trades course in tool and die-making, and the co-operative engineering course. The service course was designed to meet the needs for highly skilled service men in the service stations of the automobile companies throughout the country. The technical trades course was designed to meet the need for a supply of well-trained tradesmen in the more highly skilled trades of tool- and die-making. It is organized on the co-operative plan of four weeks in school and four weeks of practical training in the plant. The co-operative engineering course is a part of a program to meet the need of trained executives.

For the men already employed in the industry who for economic reasons must work on a regular job, a six-year program of spare-time courses was organized, covering on a night-school basis two years of training in the fundamental subjects of engineering, followed by two years of what we call junior executive training in such subjects as the historical development of industry, the elements of economics, accounting and costs, personal efficiency, and salesmanship. For young men who qualify for junior executive positions, this is followed by two additional years of senior executive courses covering foremanship and other units directly related to industrial organization and management.

The co-operative engineering course was organized to supplement this source of supply of future executives with a more broadly and technically trained group of men. The course is a four-year program of college grade for admission to which high school graduation or its equivalent is required.

The results of the Flint program are before us in definite form. A large percentage of the graduates of the service course are already in responsible positions such as service managers, service salesmen, and service foremen, after only three years of operation. The co-operative trades course is contributing to the solution of the problem of skilled craftsmen, and the upper classmen of the co-operative engineering course are in demand throughout the plants.

Wear Resistance of Dies and Shear Blades

By W. J. MERTEN

Metallurgical Engineer, Westinghouse Electric and Manufacturing Co.

SHEARING and blanking of sheet steel covered with hammer or roll scale will dull or wear down the cutting edge of die parts and shear blades and produce a burr earlier than when this scale is absent. Hammer scale, Fe_3O_4, is an abrasive material, and has a mineral hardness of 5.5 to 6.5 on the Moh scale of hardness. However, since a scale-free material is impractical for economical and commercial reasons, the use of heavy adhesive greases as lubricants has been found to neutralize the scoring tendency of the scale. The imbedding of the crushed crystals of iron oxide scale and the prevention of their pulverization, or lodging between the cutting edges, is responsible for the improved performance.

Iron silicate crystals, FeSi, in silicon sheet have a greater abrasive quality than iron scale, and react similarly on the cutting edges of tools. The tendency to dull the edge is very pronounced if a crushing or pulverizing of crystals takes place before the shearing of the sheet. Evidently any method resulting in a splitting of the iron silicate crystals without powdering or severe fragmentation aids in the retention of the sharp cutting edge and prolongs the life of the die.

To bring about the splitting of hard crystals of iron oxide or iron silicate instead of crushing them is accomplished by baking on a coating of lubricating enamel, by inserting a layer of paper between the punch and the sheet, or by depositing a soft metallic coating on the surface by dipping the sheets into a solution of hot copper sulphate or lead acetate. These coatings fill the small surface cavities and imbed the exposed hard particles, thereby preventing their fragmentation just prior to subjecting the sheet to shearing stresses. The more securely such imbedding or locking is accomplished, the greater the life and the better the performance of the cutting edge. On account of the high cost of these materials, however, they are not favored.

A striking illustration of the effect of brittle crystals rendered weak and fragile by removing from them their supporting matrix is the early dulling of the cutting edge from punching pickled sheets. Pickling acid obviously acts only on the iron matrix, the iron silicate being acid-proof. The dissolving of the iron naturally exposes the iron silicate crystals still more, and weakens their resistance to crushing stresses. Consequently a short production was obtained. The recognition of these facts explains why fluid lubricants are not successful. A more substantial and viscous lubricant is needed to imbed and hold the fragments of the split crystals of the scale.

The type of steel now most favorably considered for blanking dies and shear blades is the high-carbon high-chromium tool steel containing from 2 to 2.25 per cent of carbon and from 10 to 12 per cent of chromium.

The successful application of hard movable and stationary die parts depends to a large degree upon the rigidity of the punch while blanking. On outline dies where the entire perimeter of the punch section is used as a cutting edge, the tendency to produce a side thrust is practically nil, and a hard punch and hard die combination will work out ideally. For dies where the punch is cutting on one side of the cross section only, the soft punch is favored.

From a critical analysis of tests made it was shown that the sharp but soft punch and hard die produces a considerable dragging effect extending into the blank. The advantages from a uniformly hard punch and die in producing the minimum plastic deformation of the sheared section and the immediate adjacent material were plainly apparent.

Abstract of a paper presented at the Winter Sectional Meeting, A.S.S.T., at Washington, D. C., Jan. 20-21, 1927.

THE · FOREMAN'S · ROUND · TABLE

The Practical Joker

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"GEE, Al, you must have been peeved this morning. I heard you bawling out that new man something fierce. Seemed to be forgetting all the kind words and soft answer stuff you talk about once in a while."

"You're right, Ed, I was peeved. Didn't mean to let myself go quite so much, but I was worked up over the fool stunt he tried to pull off."

"What's it all about?"

"Well, you see, that new fellow is one of those 'practical jokers.' If he can get the laugh on somebody else, he's happy all day."

"Get something on you?"

"No—and if it was only a laugh I wouldn't mind a bit. But they never seem to think of possible consequences. Here I found him rigging up Joe Meeker's air nozzle so it would shoot air down the back of his neck when he started his machine."

"No great harm in that, is there?"

"Not much, if that was all. But you know Joe Meeker. He's a nervous bird and just at present he's upset over sickness at home and a lot of other things. Just let a blast of cold air hit him in the neck suddenly and he's liable to do most anything. First thing any man would do is to jump. That's where the new man would get his laugh. But what would happen to Joe?

"Joe would be just as likely to jump into his machine as anything. Might throw out his arm and get his hand caught somewhere. Might strike his head on any of the levers. Might do a dozen things that we don't think of—till afterward."

"Guess you're a bit fidgety, Al."

"Maybe, Ed. But I've seen several so called 'harmless' pranks that left their mark for years. Broken arms, smashed fingers, damaged eyesight and worse. Of course the joker is sorry—he 'didn't mean to have anything happen.' But it does, all too often. I like a joke as well as anyone. But when it means a possible accident to one of my men, I'm dead against 'em. And if that new chap tries any more of his jokes—out he goes."

Was Al too severe on the joker?
Are such jokes ever "safe"?
Can Ed or anyone afford to overlook jokes of this kind?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Should Foremen Be Good Actors?

YEARS ago, when I was a youngster on the farm, the shop urge became so strong that I decided to bid farewell to the old home acres and learn to be a machinist. I took a short machinist's course one summer at an agricultural college. My shop work was pitifully small but I secured a job in a small plant that was building gasoline engines. My first job was turning piston rings to width on a lathe. After a few hours on that work the foreman, who was also new in the shop, came to me with a small piece of steel that was to be tapered. I made an attempt at the job but the tool dug in and nearly spoiled the piece at the same time.

The new boss came over to my machine and exclaimed, "I have a three-year old youngster at home that can do better than that." There were more remarks that could be heard all around the shop. I was not fired but I was so badly licked that I was of no further use and returned to my acres convinced that I was no machinist.

When the hurt wore off I resolved to make another attempt. I landed a job in another city. This time it was turning small valves. The valve had several diameters and as I had only one pair of small calipers I was obliged to reset them for the different diameters on each piece. After I had worked for about an hour the boss came over to me and asked, "Do you think you are making much headway?" I had to admit that I was not. "I am afraid that we shall have to part company," was his next remark, "and you looked very promising too."

If the first foreman with whom I came in contact had not been of the hard and bitter type I need not have lost all that time. He might have let me out as did the second without destroying all of my hopes.

—GEO. WILSON, *Mechanical Engineer.*

Personal Appearance in the Shop

MEN who allow their clothes or their appearance to become slovenly soon lose the respect of their fellow workers. No matter how poor a man may be, soap and water are cheap, and a little elbow grease can add to any man's personal appearance. I have known some men to whom I would not give a job as office sweeper when it came to brains and yet these same men were considered as valuable to the company because of their personal appearance and because they were good mixers.

The employer who thinks of the welfare of his men and helps to add to the pleasantness of their surroundings is adding to the success of his establishment. No man feels much like exerting himself in a plant where tobacco juice is squirted in every direction, where the windows are dirty, and where grime and grease are scattered over everything. Shop visitors likewise are poorly impressed. That is why companies spend money on gyms and rest rooms for their men.

—F. KLINGENSTEIN.

Personal Appearance in the Shop

WHILE a lathe operator, Bill Smith was exceptionally neat in his appearance. His work was quite satisfactory. When he became a foreman, however, it began to be rumored that he even powdered his nose. He was a fairly good judge of the costs of the various operations under his jurisdiction but, of course, he could not be expected to actually demonstrate how quickly the job could be done. It would mean dirty finger nails. Result — Constant alibis from the men, surface cleanliness and small output.

Tom Jones, the foreman in a neighboring shop was a first-class mechanic. When he settled down to solve some difficult problem woe to the man that came within expectorating distance. Grease was everywhere. Stepladders were never used because it was just as easy to stand on top of a pair of cuttings or climb on a machine. He contended that no dividends were earned cleaning up. Result—Broken and worn out machinery, time lost through accidents and sickness, and, eventually, small production.

Jack Brown, another neighboring foreman was always found in a blue shirt and fairly clean overalls. When his men tried to alibi he either showed them or they showed him. They never tried to bluff by surface cleanliness. He was rarely troubled with trivial excuses. Production without unnecessary friction was his motto. The single time that he was criticized for his appearance his reply was, "You wouldn't expect to go swimming in a dress suit." Result—Increased production and the confidence of his men.—FRED PATTERSON.

THE · NEXT · TOPIC

Who Should Select New Equipment?

QUESTIONS

Does it pay to take into consideration the wishes of the men who are to operate them, when new machines are being selected?

Who should have the final say under all circumstances?

Should equipment be bought on price alone?

Who Should Keep Machines Oiled?

SINCE the operator is responsible for the performance of the machine and for the production of his work, why relieve him of the first essential of all machine operations? The occasions where the machine "freezes up" suddenly are very rare. When any sluggish symptoms appear it is time for the operator to grab the oil can and get busy.

A well-oiled machine produces more work than an un-oiled one. If the machine breaks down the operator must wait while his work is being set up on another

machine. His loss is proportionate to his wages. Oiling is, therefore, included in the piecework rates.

Another defect in Al's plan is that the machine must be stopped while the oiling is being done. In some states this is required by law. The operator himself therefore should shut the machine down a few minutes while oiling is being done. It is most decidedly wrong to waste the apprentice's time by putting him to work oiling a battery of machines.—PHIL AIDA.

Personal Appearance in the Shop

IF A foreman has to depend upon dress to make an impression, it does not speak well for his ability. Dress does not play a very important part in the day's work. Natural and normal neatness means a great deal more. If the foreman is dressed in an outright shabby fashion it is the duty of the superintendent to quietly learn the reason and see that the foreman's remuneration is adjusted so that he can afford to get a new suit a little oftener.

If it is the workman who is poorly dressed, the foreman should provide the opportunity for him to earn a little more so that he can better provide for himself. Neither the superintendent nor the foreman is justified in criticizing another person's dress because it is often impossible to know all the reasons for a man's poor appearance. Men who dress too well often have motives and aims that would not appeal to the superintendent.

—H. MAPLETHORPE, *England.*

Personal Appearance in the Shop

DRESS is all very well in its place, but that is not in the machine shop. It makes the workman avoid the messy jobs. Too much time is spent in looking pretty especially among the younger men. As to whether the foreman should speak to his men, I think that only in the last extremity should he say anything to them about personal appearance. It is so easy to give offense which will result in a permanent grouch, the last thing to be desired in a shop. Absolute freedom in personal details goes a long way to the ideal in the mind of the average worker.

The foreman should strive to strike the mean. Naturally he must be respectable, but there are few men whose appearance is positively not presentable. Men do not like to work for a foreman whose atmosphere is that of the office instead of the shop. The foreman who dresses too well avoids dirty work to save on the cleaning bill. A foreman who does not work with his hands is in a bad way with the control of his men.

—A. L. WALKER, *England.*

Why They Decided Not to Use a Jig

AL SURELY took a long chance when he let Jack talk him out of making a jig. If, when the job was first considered, a jig was deemed necessary to keep the drilling within the limits required, surely a jig was still necessary after Jack had had his say about it. Did Jack know all about where and how each piece was to be used?

If a jig was not necessary it certainly showed lack of judgment on Al's part to begin with and so long as Williams was sold on the idea of making a jig, it seems to me that if I were in Al's place I'd back Williams' idea rather than Jack's. Suppose that three or four months later Al got another order for a couple of hundred more of the same pieces and Jack and his templet were missing, would Al be likely to duplicate the order and have each piece within the required limits of accuracy? An aluminum fixture, properly made, would have been ideal in this case.

It seems, too, that Jack sets his own price along with saying how the job should be done. If Jack, Bill and Joe all do the same, what excuse is there for Al's collecting his wages on pay day? It is all right to listen to suggestions but the successful foreman knows when the suggestion is good or bad. Al had better get both eyes open. —WALTER E. SHANNON, *Toolmaker.*

Should Foremen Be Good Actors?

MY POSITION was formerly held by one of the bulldozing kind of foremen. The reason that he lost his job was too much labor turnover. Having to constantly break in new men, he lost production. His best men quit when they got tired of his surly methods. The habit was so strong that he could not give his superiors a civil answer. Men who do not carry it to an extreme, however, can frequently succeed because men will make some allowances.

In giving orders to my men I get the best results by learning the nature of each individual under me. Some can be reasoned with and some require a quite determined treatment. Even determined methods can be quiet, however. The men will like the foreman better and be more willing to co-operate. It creates a better atmosphere and it becomes soon apparent that it is worthwhile for the foreman who is naturally inclined to be hot-headed to control his temper.

—J. HOWARD STUDHOLME, *Master Mechanic.*

Should Foremen Be Good Actors?

THE success of the foreman can usually be judged he quality of his acting. The quiet man is usually the more successful since he is usually a natural actor and has better control over his emotions. This ability is essential in handling men. This type of man commands more respect from those over him and under him, than the kind of man who is loud, garrulous or abusive.

The loud, crude foreman is often the one who is afraid of losing his authority and consequently trying to keep everyone far enough away from himself to prevent its being discovered. The quiet man is usually sure of his ground and, therefore, less confused. He will be more efficient. He seldom fires a man in a fit of temper when a quiet correction will save a good employee to the company.

Although he does not realize it, Ed is already acting. A change in rôle will, however, be difficult for him and it must be gradual in order to be effective. His men will think that he is becoming "human' if he is careful enough in toning himself down and if he acts his part well. —T. HOMER THOMAS, *Superintendent.*

Personal Appearance in the Shop

INDIVIDUALS with careless habits of dress are usually found to be workmen with little thought of the finer things of life. Yet the fellow who starts Monday morning with a clean suit of overalls and is capable of good work, does just as good work at the end of the week regardless of his soiled and knee-bagged overalls.

There is no reason why a foreman should not be well dressed except in so far as personal expense is a factor. The psychological effect upon the men is worth the expense and a superintendent realizing this feels justified in speaking firmly to his men regarding their personal appearance. On the whole it is as essential to be well dressed in a machine shop as it is elsewhere.

—STORRS T. RICHMOND, *Master Mechanic.*

Should Foremen Be Good Actors?

BRAWLING, snapping, cussing foremen always get a reaction that is bad for the shop. If Ed adopts the manner of a teacher and shows his men the "how" and the "why" of their work, they will be more willing to help him. He would not have to ask them to speed up their lathes because he would be busy teaching them why their lathes should be speeded up. He would have them thinking and acting in a manner that would boost production.

The quiet foreman usually digs deep into the ethics of his job; helps his men to study their work. The gang of a bullying foreman will hang back, their hanging back will arouse the ire of the foreman even more strongly than before and the quality of the work will suffer. —C. L. HENRY, *Foreman, England.*

Personal Appearance in the Shop

CORRECT habits should be learned by the men when they are still apprentices. As they grow older they will tend to be less flexible and more tied down to their habits. I am working constantly with apprentice boys and have found that it brings results to gather them together and talk to them about their haircombs and their clothes. Speaking to them in a group casts no personal reflections on any of them.

Most shop visitors have a pleasanter impression of a shop where the clothes are kept clean even if they are patched. The foreman should dress well and to protect his clothes he should wear a shop coat. A neat shop often means a neat product and even a neat profit.

—JOS. E. ABBAZIA, *Mech. Instr.*

Personal Appearance in the Shop

USUALLY the man who is careless in his dress is the one who is careless in his work. In the case of Ed's apprentice, however, I think that Ed is wise in waiting to see what the youngster is going to do when he gets a raise in wages. If there is a change in his personal appearance it will show that he realizes the importance of dress and that he is not naturally careless.

In most shops the workmen take their cues from the foreman. It is up to him, therefore, to be a pattern of neatness, but he must go a step farther. Cotton waste should be provided for the men so as to eliminate that dirty habit of wiping greasy hands on overalls. This will instill into the men a respect for their appearance. Today the buyer wants to see the shop where his purchase is made and the appearance of the workmen will affect his impression of that shop.

—NEWTON E. GEOFFREY, *England.*

Should Foremen Be Good Actors?

AT TIMES one may feel justified in resorting to the hammer method of discipline because it seems to be the court of last appeal. But why should one who is trusted with authority and with the discipline of others so far lose his own poise and lower his own dignity as to employ the methods that are expected only from the most ignorant?

The foreman ought to have the ability to lead others, not to drive them. He must, therefore, be a good actor. When he is tempted to surrender to the primitive instincts that are within him he must remember that his is a position of trust and that he should administer any necessary drastic treatment with a poise, dignity and firmness that will leave him the master of the situation. —RAYMOND W. HICKS, *Instructor.*

Personal Appearance in the Shop

TAKING modern living conditions as a whole, I think it is generally conceded that we are far in advance of half a century ago in nearly all respects. Young men and women have greater facilities for mental application than our grandfathers dreamed of. This air of refinement, following in the wake of intensive education, shows itself in the dress and conduct of the man or woman. It will also create an impression of intellectual advancement to a community, visitors, and prospective customers.

If the Super had scoffed at Ed's suggestion, the foreman would have had a right to put him in a lower class than his own. It certainly would not improve the foreman's attitude toward the shop as a whole.

—R. PARKES, *Apprentice.*

Personal Appearance in the Shop

JOHN was very much interested in his work the other morning. He didn't even notice me. He was piling up finished screw machine parts so fast that they were all he could see. As I approached him I heard him murmur to himself, "She said yes." I asked him if he was dreaming but he said, "No; my girl promised to marry me, will you give me a raise, boss?"

You can quickly notice the improvement in a man's work when he is happy. On Monday morning when the men have on clean overalls they are always brighter and happier. The ones who come in Monday morning with dirty overalls are reminded of work and worries. It might be advisable to establish a company laundry for overalls.

Has the management a right to tell the men how to dress? No. The only time when either the foreman or the superintendent has a right to say anything about it is when the company furnishes the men with overalls or has the facilities for laundering them. The company can advertise the subject of personal appearance but it cannot criticize the employee. —D. H. SINGER.

Ideas from Practical Men

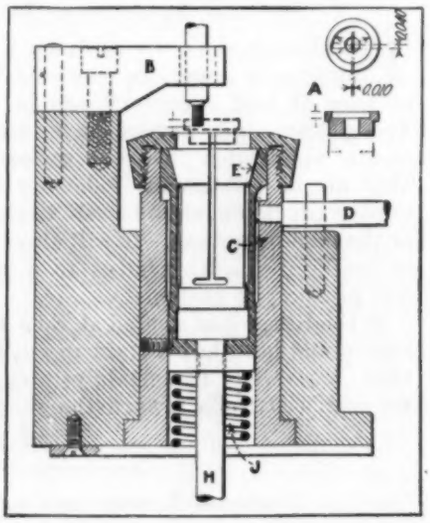
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Fixture for Milling an Eccentric Curve

BY B. J. STERN

The fixture shown by the accompanying sketch is for milling the eccentric cam-curve in the recess at the larger end of the small brass piece indicated at *A*, the piece having previously been finished all over, except for the curve, in a turret machine.

The fixture is used in a drill press, in the chuck of which is a small end-mill of special shape that is steadied by a bushing in the bracket *B* while engaged with the work. The spindle of the drill press is raised to get the mill out of the way while unloading and reloading the fixture, its stop-collar facilitating the return of the mill to working depth. The fixture consists of a cast-iron body, to be clamped to the table of the drill press, having a rotatable concentric bushing *C* with handle *D* to turn it back and forth upon its axis within limits set by suitable stop pins. A shoulder at the lower end, fitting a counterbored recess in the body of the fixture, prevents it from lifting, while a thin bottom plate secured to the body by countersunk-head screws, transmits all downward thrust directly to the table of the drill press.



A fixture for milling cam-curves

Within the bushing *C* is a second bushing *E*, which is free to slide endwise but is restrained from relative rotation with respect to bushing *C* by means of a dowel-pointed setscrew in the latter. The bore of bushing *E* is made to conform to the shape of a spring collet, which its endwise movement serves to open and close. The spring collet and bushing *E* are retained in bushing *C* by a threaded nose-collar at the top of the latter.

Bushing *E* may be retracted to allow the spring collet to open by means of the rod *H*, which is attached by a chain to a pedal below the drill press table. A heavy coil spring *J*, in the chamber between the sliding bushing and the bottom plate of the fixture, forces the bushing upward to keep the collet firmly closed except when the pedal is pressed down by the operator's foot.

Both the bushing *E* and the spring collet are standard B. & S. parts, except that the latter has an eccentrically bored recess at the nose end to locate the work off-center by an amount necessary to produce the required eccentricity of the cam-curve.

The cycle of operations consists of depressing the pedal to open the collet; inserting the work and releasing the pedal to allow the collet to grip the work; bringing down the spindle of the drill press to its stop, thus engaging the cutter in the work; giving the bushing *B* (and its contained parts) a partial turn by means of the handle until stopped by the limiting stop-pin; raising the drill-spindle to lift the cutter from the work; and turning back the handle to its original position against the other stop-pin.

Pulling-In Locomotive Valve-Chamber Bushings

BY J. MADDEN

A device used in a railroad shop for pulling-in replacement valve bushings by means of an air motor is illustrated in Figs. 1 and 2. The motor, at the front end, driving through a reduction gear, turns a screw that extends through the valve chamber into a pulling block and nut at the rear end. A wrench, at the rear end, braced against some convenient part of the locomotive, prevents the nut from turning with the screw. Riding on the shank of the screw is a large collar that

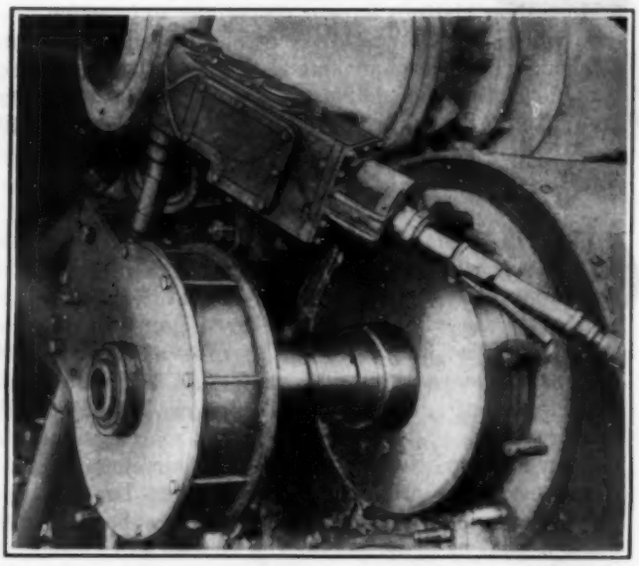


Fig. 1—Air-driven device for pulling-in valve bushings —front view

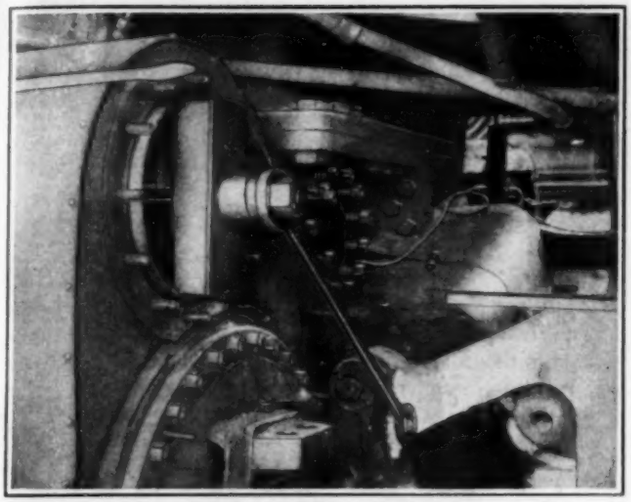


Fig. 2—Same device—rear view

bears against the outboard end of the front bushing.

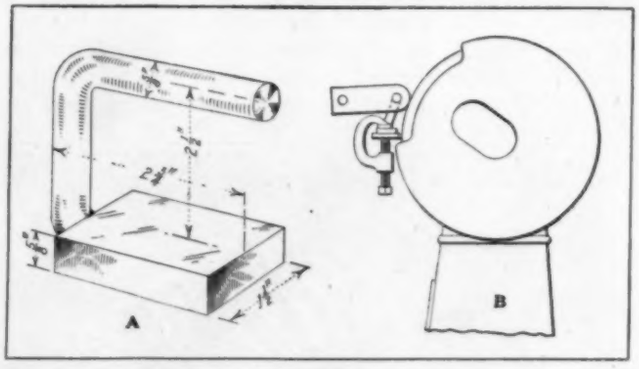
Whether the front or rear bushing goes in first, or the two bushings go in alternately by comparatively short steps, depends upon which bushing has the looser fit, and the uniformity and smoothness of the bore of the valve chamber and the turned surface of the bushing. No matter what the order of movement, both bushings will eventually be pulled against the ring, or internal flange, of the valve chamber, provided to serve as a stop, or seat, for the ends of the bushings.

Device for Rounding Corners

By J. Z. Bromley

The device shown in the illustration at *A* has been found to be convenient and rapid for the rounding of corners on the ends of flat links and levers. It is made of a piece of flat, cold-rolled stock, turned and bent as shown. The dimensions given can be altered to suit any individual case.

The application of the tool is shown at *B*. It is clamped to the tool rest of the grinder with an ordinary C-clamp, and the link or part to be rounded is slipped



The device and how it is used

over the tool, the free end being swung upward to grind off the upper corner, then downward as far as possible, grinding off most of the lower corner. The link is then turned over and the free end is again swung upwards completing the operation.

With two sizes of this tool and an assortment of suitable bushings, we are able to round the ends of all links used in our manufacturing operations.

Gashing Circular Formed Tools—Discussion

By Stanley Porritt

Referring to the article by David G. Kallstrom under the title given above, and published on page 1074, Vol. 65, of the *American Machinist*, in our plant we slit the gash with a rubber-bonded wheel $\frac{1}{4}$ in. thick instead of grinding away all of the metal. The principal requirements are care in starting the cut and a possible touching up of the cutting edge in case the thin wheel wabbles.

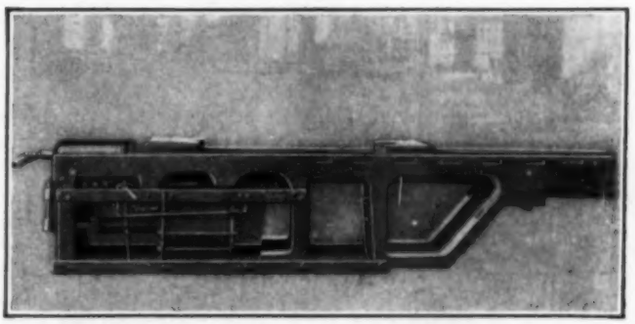
This method is as quick, or quicker, than grinding away all of the stock, and in addition, a large plant may save several hundred pounds of valuable high-speed steel in the course of a year. If it is the custom to mill the gash before hardening the tool, why not use a saw instead of the formed cutter and still save the scrap?

I believe a circular cutter should be gashed after it is hardened and ground, as it is quicker and easier to work on the full circle.

A Pneumatic-Hydraulic Draw-Bar Shortener

By J. Monroe

The pneumatic-hydraulic draw-bar shortener illustrated is in use in the Great Northern shops at Delta, Wash. Air at 90 lb. pressure actuates the piston of the air unit, which is 18 in. in diameter. The hydraulic



Pneumatic-hydraulic draw-bar straightener

plunger is $1\frac{11}{16}$ in. in diameter. Oil is used as the hydraulic medium. Heat is applied to the middle of the draw-bar. The block on the right-hand end of the machine may be located in any one of several positions to accommodate bars of different lengths.

Grinding Helical Cutters

By H. B. Schott

The method of grinding helical cutters is practically the same as that employed in grinding what were formerly known as spiral cutters. The axes of the cutter and the grinding wheel should be kept parallel, regardless of the helix angles in both cases. The difference in grinding a helical cutter lies chiefly in the shaping of the tooth rest and in the shape the wheel is dressed.

The top of the tooth rest should be ground slightly curving. For a rest $\frac{3}{4}$ in. wide, the curvature should be such as to clear the cutter about $\frac{1}{32}$ in. at the sides when its center is in contact with the cutter. See Fig. 1.

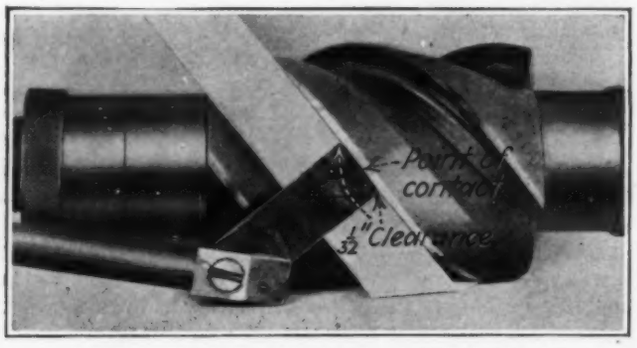


Fig. 1—How the tooth rest should be set

The sheel should be dressed to the shape shown at *A* in Fig. 2. The quickest way to set the rest so that the clearance will be equal at *B* and *C* is by trial, though the angle *D* should be the same as the helix angle of the cutter. Set the rest so that the contact point of the cutter and wheel will be on the vertical center of the wheel. Thus the cutter, the wheel and the rest will all be in contact at a common center, as shown in Fig. 2. The proper amount of tooth clearance can be obtained by moving the tooth rest below the center of the wheel spindle the same distance as for any cutter.

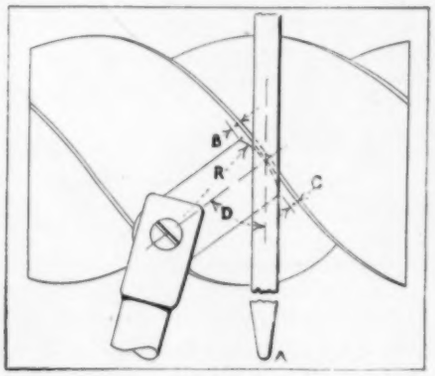
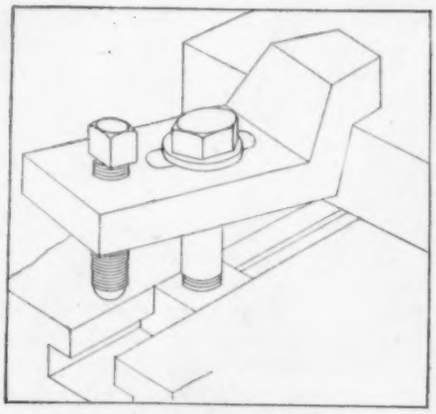


Fig. 2—The shape of the wheel and its relation to the cutter

Handy Straps for the Toolmaker

By H. L. Wheeler

A pair of straps such as the one shown in the illustration will save a lot of time that might otherwise be spent in searching for blocking of suitable height. They can be made of mild steel and pack-hardened if desired. An elongated slot accommodates the clamping bolt and provides a certain amount of adjustability. The setscrew in the outer end takes care of the difference in height between different pieces of work, and may be adjusted in a minimum of time. Straps of this kind occupy but little space in the toolmaker's kit, and will save their cost if there are many pieces to be swung up on faceplates or strapped to the grinder or milling machine.



An adjustable strap

Cutting Large Worms

By Henry Densmore

In a certain machinery building plant there are a number of large multi-start worms like that shown in Fig. 1 to be made periodically, but never in sufficient quantities to warrant the costly special machine that would be required to bring the job into the strictly manufacturing class. The machine and method here described suffice to turn out the product at a gratifyingly low figure.

The machine used is a very ordinary engine lathe with the usual leadscrew and full complement of change gears for thread cutting, but neither screw nor gears have any part in this job. For each different lead of

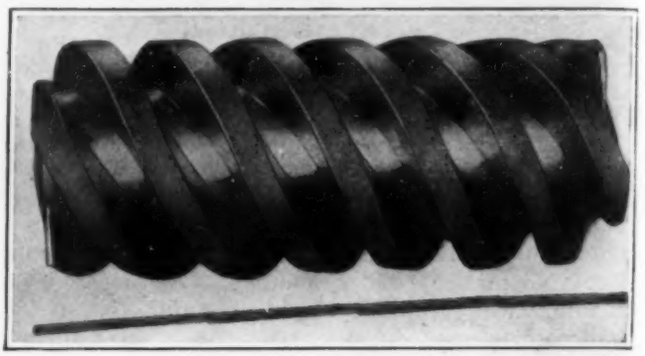


Fig. 1—A large four-start worm

worm to be cut there must be a master worm, made by the usual toolroom methods in a universal milling machine.

Each master worm is keyed to an arbor that is long enough to carry also the blank from which the new worm is to be cut. The blank is likewise keyed to the arbor and is further secured by a nut. Each arbor has at one end a substantial driving plate, to be secured to and driven by the regular drive plate of the lathe. Several of these arbors and master worms may be seen in Fig. 2, and in Fig. 3 is another arbor with a partly cut worm upon it, in place on the centers.

Bolted to the wings of the carriage on the left side is a bracket *A*, upon the cross-tie of which is planed a guideway like that of the bridge of a lathe carriage, and to it are gibbed two small cross-slides that are

Fig. 2—Master worms and arbors

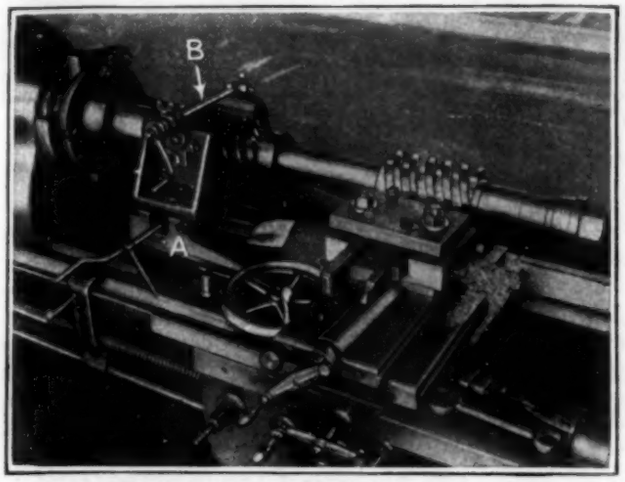


Fig. 3—Set-up for cutting a worm

actuated to and from each other by a right-and left-hand screw. This screw has no thrust bearing, but is allowed to float endwise so that the cross-slides are brought to bear with even pressure upon whatever is between them.

The cross-slides are made in the form of angle plates, to the faces of which are bolted cast-iron shells to hold babbitt castings, which castings are poured with all parts in place, and thus constitute a leadscrew locknut of exactly the same principle as the corresponding part behind the apron of the carriage, but much larger.

A swinging bolt *B* is pivoted to the rear cross-slide, from which it swings forward to engage a fork on the front slide, and it is put under tension in this position by a nut that is made like a crank-handle. When set up for a job, the two half-nuts remain in engagement with the master worm, which thus becomes the leadscrew, being held together by a right- and left-hand screw below, and further secured by the swinging bolt at the top.

The arbor carrying the master worm and the blank to be cut is placed on the centers, and the studs are adjusted to equalize the torsional strains upon the drive plate. The half-nuts corresponding to the master worm are secured to the cross-slides and are brought into engagement with the worm. The work of cutting is done by running the lathe forward with the tools in the cut, withdrawing the tools by means of the regular cross-slide and reversing the lathe to run the carriage back to the starting point.

On a four-start worm, the roughing cut is carried to within a few thousandths of finish size by two tools, cutting alternate threads simultaneously. When the first and third threads have been carried as far as is advisable to go, the half-nuts are disengaged and the carriage of the lathe moved by hand backward (or forward) to bring the tools into position to cut the intermediate threads, when the locknut is again closed. On the finishing cuts the procedure is the same except that but one tool is employed.

The rack and pinion of the carriage apron remain in engagement during the operation, but to avoid interference from the handwheel—which would rotate rather rapidly on these coarse pitches—the operator takes it off of the stud and puts it where he can reach it conveniently when necessary to make a lateral adjustment of the carriage.

Fixture for Milling Keyseats

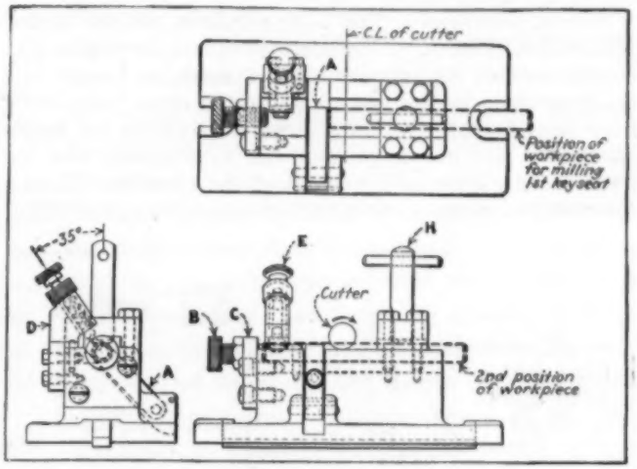
By Robert W. Haggar
Guelph, Canada

The fixture illustrated was designed for holding shafts while keyseats were being cut in them. Each shaft has two keyseats for No. 6 Woodruff keys. The keyseats occupy different lineal positions on the shaft and are at an angular distance of 35 deg. from each other.

The shaft is held in a V-block, the left-hand end being in contact with the swinging stop *A*. An additional and adjustable stop *B* is carried in the plate *C*, secured to the end of the fixture.

The bracket *D* is fitted with the spring-actuated index pin *E*, the inner end of which is a wedge fit in the keyways.

With the shaft against the swinging stop, and held in position by the clamping screw *H*, the keyway nearest the end is cut. The swinging stop is then swung outward, the clampscrew is loosened, and the shaft is moved until its end contacts with the adjustable stop *B*.



Indexing fixture for milling keyseats

It is then turned until the index pin engages the keyseat just cut. These movements bring the shaft in position for cutting the second keyseat.

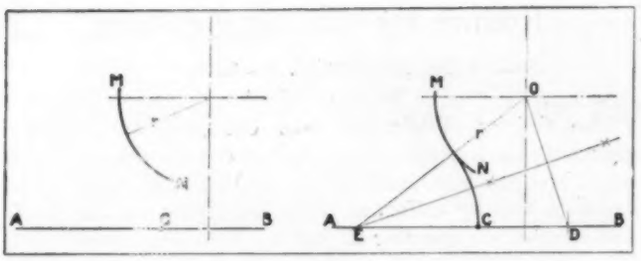
It will be noted that the shaft, and not the machine table, is moved for positioning for cutting both keyseats. The only change in the adjustment of the machine is the raising and lowering of the knee as the keyseats are cut and the cutter is cleared from the work. The fixture is accurate, simple to operate and is practically foolproof.

A Problem in Drafting

By M. A. Durland

A typical problem that sometimes arises in drafting work is shown in the accompanying sketch. The object is to locate on the line *AB*, the center of an arc that will be tangent to the given arc *MN* and pass through the point *C*. The solution can be found by "cut-and-try" methods, of course, but I do not believe any definite procedure has ever been proposed. I think the solution indicated is both original and interesting.

The solution is as follows: Lay off on the line *AB*, the distance *CD* equal to *r*. Connect points *D* and *O* and



Sketch of the problem

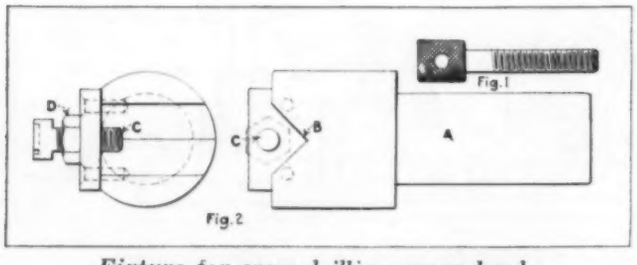
at the midpoint of this line erect a perpendicular to it. The point *E*, where this line intersects *AB*, is the center of the required arc.

Proof: *EO* equals *ED*, since they are homologous sides of an isosceles triangle. Also *CD* equals *r* by construction; therefore, the distance *EC* is equal to the distance from *E* to the given arc.

Cross-Drilling Device

By Robert Julian
London, England

Several thousand screws were required, similar to the illustration, Fig. 1. They were produced in the orthodox manner on an automatic screw machine, except for the cross hole in the head. While the cross hole could have been drilled with an attachment fixed to the automatic, we did not have such an attachment, and to purchase one especially was out of the question. Therefore we made the simple and cheap device illustrated



Fixture for cross-drilling screw heads

in Fig. 2. *A* shows a drill-pad having a V-shaped groove *B* cut across the axis of the large end.

The adjustable stop *C*, held in adjustment by the lock nut *D*, serves to locate the work for the cross-hole.

The drill pad was used on a small lever-operated capstan lathe, a short drill being gripped in the chuck, while the drill pad was placed in the turret. The screws were placed in the V with their heads against the stop and were held in place by hand, the drilling being done by feeding the turret forward. It will be noted that the drilling operation is a very rapid one, since there are no cams or holding devices used, and the chips fall away as fast as they are made.

After completing the job we felt sure that, had we possessed a drilling fixture for the automatic, the work would not have been produced more economically, owing to the increased complication of the set-up and the slowing up of production, which usually follows when attachments of this kind are used.

Our screws were drilled at the rate of 150 per hour.

Money is useless unless the food you want to buy is being raised and the things you want to use are being produced. It is the changing of raw materials into things we need or want, that *makes* for prosperity.

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Machining Highly Carbonized Steel

Q. We have to repair what is known as "rock bit cones," which are the cutters used in drilling oil wells. These cutters are made of 40-50 point carbon steel, carbonized and hardened. We anneal and turn them down until the teeth are true, then recarbonize and reharden them. But we have not been able to soften them enough so that we could machine them at a reasonable speed, even though we have held them at a high heat for 15 minutes and then cooled them slowly in lime for a period of 36 hours. Can you suggest how to soften them?

A. Highly carbonized steel cannot be annealed sufficiently in a short period to make it easily machinable without decarbonizing, and we do not know of any cheap and effective method of decarbonizing tools of this kind.

Holding at a high heat for long periods and then cooling slowly over a long period in the furnace, or without removing from the annealing box, will obtain a soft state that will enable the tool to be machined satisfactorily, but we realize that this is not commercially possible for the ordinary shop.

We advise employing a higher grade of steel at the outset, which will not have to be carbonized, and will not give you the same trouble in annealing. At the same time it will probably give you better service in the tool. Otherwise, you should attempt to repair the tools by grinding instead of truing them up by turning.

Material for Laps

Q. What is the best material for a lap?

A. A general principle is that the material in the lap must be softer than the material of the part to be lapped, so that the abrasive will always charge the lap. Laps for steel bushings may be made of copper, brass, or cast iron. The lap is made to fit the hole, and is split so as to be adjustable with either a screw or a wedge. For hard usage the softer laps wear out quickly, and the copper lap is probably most frequently employed, but for fine finishing a lead lap will give excellent results. It holds the abrasive, and will keep its shape if the cuts are not heavy.

Lubricant for Heavy-Duty Bearings

Q. One of our machines has a set of bearings which have to stand a fairly heavy pressure, and we find that they heat up rapidly. We have tried numerous types of oil, and are thinking of changing to graphite lubrication. The bearings are babbitted. How should they be changed to adapt them for graphite?

A. You will probably be able to note a decided improvement by adding a small percentage of graphite, about ½ of 1 per cent, to the lubricating oil. This is a large enough proportion of graphite to spread over the bearing and produce a smooth film, while requiring no special design of bearing or oiling devices. A much larger percentage, however, will thicken the lubricant and clog the oil holes.

Soft Solders and Their Application

Soldering in the process of joining two metals by the application of a molten alloy. It differs from welding in that the base metals are not fused in the process, and it differs from brazing in the nature of the alloys used to make the joint. Soft solders of the tin-lead alloys are in reality metallic cements possessing the property of adhering only to metals with which they are capable of alloying. The solder penetrates into the base metal, and when force is used to separate the two soldered surfaces the break will occur in the solder between the surfaces. The thicker the layer of solder, the easier it will break. Closely fitted surfaces, with a minimum of solder, are therefore essential for the best soldered joints.

The simplest form of solder is a mixture of tin and lead. Tin is not employed alone as it is expensive, and requires more skill in handling. It flows easily, and spreads beyond the surfaces to be soldered. Lead, on the other hand, is difficult to work, does not flow easily, and will not hold to the base metals. The common commercial solders called "half and half" do not always contain half proportions of each metal, and when too much lead is used to make a cheap solder, or when zinc and antimony is present, great difficulty is likely to be experienced in making satisfactory soldered joints.

Pure lead has a melting point of 619 deg. F., and pure tin melts at 450 deg. F. Mixing two metals into an alloy, however, lowers the melting point, and it is possible by making the right proportions of each alloying metal to reach the "eutectic" alloy whose melting point is the lowest possible. This tin-lead alloy is found to have a combination of 68 per cent of tin and 32 per cent of lead, and has a melting point of 356 deg. F. By alloying other metals in turn with the tin-lead alloy it is possible to lower the melting point still further. Bismuth and cadmium, with melting points of 507 deg. F., and 608 deg. F., respectively are used for this purpose. Very low melting solders are made up of alloys of tin, lead, bismuth, and cadmium, which are used for soldering on soft metals. An alloy has been made with a melting point of 158 deg. F., and will melt readily in hot water. This type of solder is used in connection with automatic sprinkling systems.

Solder should be chosen to suit the nature of the base metals and of the conditions of the work. A solder containing 85 per cent of tin and 15 per cent of lead, melts at 406 deg. F., is free flowing, and is used for general soldering in electrical work. Another solder in general use contains 42 per cent of tin, and 58 per cent of lead. The melting point of this alloy, however, is 458 deg. F., and it flows and sticks with somewhat more difficulty. Solder should always have a lower melting point than that of the base metal.

Solder is furnished commercially in various forms, the most common of which are wire, bars, ribbon and ingots. It is also made up as hollow wire and filled with an acid or rosin flux. Having determined the best types and grades of solder for the work of the shop, it is important to see that this material is furnished regularly for the jobs. Solder for shop use should not be bought indiscriminately from local commercial stocks without full assurance of its content.

Cheap solders, or home-made solders made up in the shop without chemical analysis, are liable to contain impurities that make them unsuitable for use. Any trace of zinc in solder makes it almost worthless. It makes the solder sluggish, and the molten alloy runs in irregular waves and lumps. Antimony makes solder bright in color, but when much of this metal is present the solder is sluggish and brittle. Copper, aluminum, iron and sulphur are also detrimental to all soft solders. Money saved through buying cheap solders is usually lost by the increased cost of the actual work of soldering the parts.

Fluxes are necessary for all soldering work, since a thin film of oxide is formed on the metals by the heat, and a flux is required to prevent or dissolve this oxide. The most common flux is a solution of zinc chloride, made by dissolving metallic zinc in muriatic acid. But where the acid flux is undesirable as for some electrical parts, common rosin, or rosin and alcohol, is sometimes used. For the latter ½ lb. of rosin is dissolved in about a quart of alcohol.

To obtain good soldered connections, the surfaces to be soldered must be cleaned thoroughly, and the iron must be kept hot enough to heat the surfaces and make the solder flow freely. A small soldering iron loses its heat too rapidly, and should not be used except where space will not permit the use of a large iron.

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Technical Abstracts

Pyroxylin Finishes

Economic superiority of pyroxylin finishes over varnishes lies in their quicker application, quicker drying, and superior finishing qualities, as well as the great reduction in manufacturing space, labor, and material in process which they permit.

Chemically the two differ radically. Varnish consists of a solution of gums in spirits or oils, while pyroxylin is a solution of nitrated cotton or other vegetable fibers in chemical solvents.

Baked enamel finishes began to be popular with the automobile trade. The drawbacks to the baked enamels are the difficulties of producing them in any range of colors, and the temperatures at which they must be finished.

The possibilities of pyroxylin to the automotive industry lie in its promise of increased body production with decreased manufacturing space and labor. Unlike varnish, pyroxylin finishes are not affected by heat or cold, light, rain, oils, or alkalis. Nor are they easily scratched. Pyroxylin finishes are applied with an air spray.

The preparation of pyroxylin is very complex, although chemically it is a solution of cotton treated with nitric acid, in a chemical solvent. The colors are largely made up of earths, mineral colors, and coal tar dyes.—*Ford News*, Jan. 8, 1927.

Blast Furnace Efficiency Increases

During 1926, the production from the older blast furnaces was greatly increased. The 374 serviceable blast furnaces in the United States now have a greater per-stack capacity than ever before.

The direct causes of increased output are: Richer ore mixtures, better coke, higher blast-temperature, and smoother operation.

All of the furnaces built in 1926 are directly connected with byproduct coke ovens. Besides the benefits to the blast furnace in having cheaper and better coke, there are advantages to the coke works in being connected with the blast furnace, especially in the use of power for which the steam is generated by waste gases from the blast furnace.—Ralph Hayes Sweetser, in *Iron Trade Review*, Jan. 6, 1927.

Reclaiming Scrap Car Axles

By utilizing an upsetting forging machine, and increasing die dimensions to accommodate axles as large as 6x11 in., it is possible to accomplish all forging operations necessary for reclaiming axles in one machine and at one handling for each axle end. The axle, heated well through the wheel seat, either one end at a time or all over, first is placed in the top groove of two dies, where the worn end collar is removed by punching off. It is then transferred to a swaging groove in the middle of the die, where the wheel seat is reduced about ¼ in. in diam. by squeezing twice; turning the axle at 90 deg. between squeezes. This method elongates the axle sufficiently to allow a liberal finish at the worn inside journal fillet, and establishes a definite diameter at the wheel seat for gripping the axle for the next upsetting operation. The axle then is placed in the lower groove of the die, where an end collar is formed by upsetting the axle to the correct length. During this operation, instead of using a back stop, as in the past, to hold the axle against the pressure of the heading tool, it is gripped by the dies at the wheel seat, where it has been reduced to a definite size by the preceeding swaging operation.—*Forging-Stamping-Heat-Treating*, January, 1927.

Our Apprentices Are Making Good

The apprentice training system of the Baltimore and Ohio Railroad offers an opportunity to learn arithmetic, the particulars of the various trades, and mechanical drawing. A minimum of two lessons per month is required of each apprentice. If there is anything that the student does not understand, there is always someone to help him.

The supervisors and mechanics at every station give assistance. At a number of stations arrangements have already been made for coaching the apprentices. The instructors visit each station at least once each month to give information to those needing help. Although two is the minimum number of lessons required, a large number of students are considerably in advance of this schedule which is compulsory. Those who fail to send in the two lessons required—one in general instruction and one in mechanical drawing—during any month, are necessarily considered delinquent.

Apprentices not in good standing and who are delinquent for any three months during their apprenticeship, and who have not made an honest effort to make up their back lessons, are not retained by the railroad. An opportunity is given those delinquent for two months to clear their records by completing their back lessons. No delinquent is dismissed before he is given a fair hearing by an officer and in the presence of a shop committeeman.

During the month of November, 1926, the railroad had 952 apprentices taking this instruction, of which 319 were at that time in arrears of their schedules, 255 exactly met the requirements of two lessons per month, and 378 were ahead of schedule. This means that 633 of the 952 apprentices were on or ahead of the schedule required of them.—*Baltimore and Ohio Magazine*, January, 1927.

Hand-to-Mouth Buying

Recently the Farmers' Loan & Trust Co., New York, obtained the opinions of a number of American big-business leaders on the subject of the practice of hand-to-mouth buying and its effects on the business of the country. Some of the replies are summed up as follows:

This method of buying has been followed for the last five years, and while some believe it is the correct method, others think that it has been carried too far. It is obvious that hand-to-mouth buying and small orders go hand in hand. A stock must be on hand to carry on, and the wholesaler and retailer should carry some of the burdens of the manufactured stock.

Hand-to-mouth buying will aid simplification and quick profit returns, but if carried to the point where it interferes with the market through inadequacy of distributors' stocks the practice becomes unsound, and will add to the cost of production and distribution. The practice benefits the retail man, but shifts a heavy burden onto the manufacturer. Hand-to-mouth buying releases capital, but adds other problems whose ultimate effects are not yet clear due to lack of experience.—*The Advertisers' Weekly*, Jan. 8, 1927.

The Cathode-Ray Tube

The cathode-ray tube developed at the research laboratories of the General Electric Co. has been improved during the past year by devising a system of sealing it off from the exhaust pump, thus making it portable. The maximum operating voltage in the larger tubes now being made is 400,000.

The electrons of the cathode-ray stream are supplied by a coiled tungsten filament, or hot cathode heated to incandescence by a relatively low voltage. The other electrode, or anode, is the nickel "window" which is soldered to a disk of invar. By impressing high voltage between the electrodes, electrons are driven from the hot cathode to and through the anode or window with a velocity of about 150,000 miles a second.

The window is very thin although equivalent to the thickness of about 500,000 layers of atoms. In terms of electrons, however, it hardly exists, since there is so much space between the electrons forming its atoms. For this reason it permits the high-speed electrons from the hot cathode to pass through it into the air. The air is barred from entering the tube because the gas molecules are too big to go through the spaces between the electrons in the atoms of nickel. The window has an area of about nine square inches, and must withstand a pressure of 100 lb. from the atmosphere. It is therefore supported by a honeycomb structure of molybdenum.

Another feature of the tube is the use of a protecting shield, a copper tube extending lengthwise from near the cathode and attached to the invar disk which supports the window. This tube confines the stream of electrons and keeps them from impinging on the glass. Thus high-voltage sparks through the glass, with consequent punctures and destruction of the tube, are avoided.

The high-speed electrons delivered by the cathode-ray tubes are similar in character to the electrons liberated by the disintegration of radium. The electrons given off by radium are of higher velocity than those so far produced by the cathode-ray tube and the rate at which they are produced by the disintegration of radium is beyond control. The rays produced by any of the recently constructed cathode tubes exceed in quantity those which could be produced by a ton of radium, and the rate of production and the depth of penetration of the tube rays are under absolute control. This characteristic is of great value in experimental work and may be of vital importance if these rays are utilized in therapeutics.—*General Electric Review*, January, 1927.

A New Paint and Varnish Remover

Para cymene, the chief constituent of so-called spruce turpentine (sulphide turpentine), is formed during the cooking of the wood in the sulphite digesters. The oil is collected by condensing the steam that escapes from the digesters during the blowing out process. Recent experiments have shown that mixtures of p-cymene with organic solvent, such as ethyl alcohol, acetone, methyl-alcohol normal mutyl-alcohol, and isopropyl alcohol, are excellent paint and varnish removers. In these mixtures p-cymene has the advantage over other solvents that have been used in that connection, such as benzol, in that it has a comparatively high boiling point.—Max Phillips and Marshall J. Goss, in *Chemical & Metallurgical Engineering*, December, 1926.

Improvement in the Various Types of Railway Motive Power

Recent development in the locomotives used on American railways, although it presents novel departures and an accelerated rate, follows the usual directions. There has been the usual increase in the maximum tractive force of locomotives in response to the unremitted demand for motive power capable of hauling heavier trains. Their is no general tendency to increase the total axle load which remains in the neighborhood of 60,000 lb. This weight is occasionally exceeded, and one locomotive now in process of design will carry 70,000 lb. on each driving axle. One of the most significant recent changes in design is a radical increase in the area of the grate, accompanied by a corresponding increase in the volume of the combustion space. Until recently, 70 sq.ft. was considered a large grate area, but this area, within the last three years, has been increased to 100 sq.ft., and in one instance to 108 sq.ft. Another important development in general design is the use of limited cutoff in locomotive cylinders. There has been a recent revival of interest in the use of three instead of two simple cylinders on the locomotive. Three cylinders have been frequently used on compound engines, but what is here referred to is the use of three simple cylinders, each of which receives steam at boiler pressure.

The designer's success in realizing these aims is attested by the fact that we now have non-articulated locomotives that develop nearly 100,000 lb. tractive effort, as much as 4,700 hp.; that deliver the horsepower for about 16 lb. of steam and less than 2 lb. of coal; and whose thermal efficiency consequently is a little over 8 per cent.—Edward C. Schmidt, in *Engineering News-Record*, Jan. 13, 1927.

Lighting System for a Large Machine Shop

The machine shop of the Hubbard Steel Foundry Co., East Chicago, Ind., is arranged so that daylight lighting is provided by natural light through the large area of continuous steel sash extending practically all the way around the building. Artificial light is provided by a system of general illumination, in which the lighting units are so placed and controlled that when necessary only small sections of the shop, such as around a single machine, need be illuminated. There are no individual lights on any machine. The illumination is obtained from a number of 500-watt lamps mounted on the columns of each side of the bay and below the collector rail. Other 750-watt lamps are mounted on the roof tresses and above the crane way.

The side lights are about 30 ft. above the floor level, and the special elliptical shape of the reflector directs the light along the side of the bay and around the machine tools instead of out toward the center of the floor area. The central area is lighted from the overhead units that also spread their light over the width of the bay and so illuminate shadows which would result if only the sidelights were used.

Another interesting feature in the control of the lighting units is that each light is operated from an individual switch instead of groups, excepting in the lean-to where two lights are on one switch. Power for the machine shop and the cranes is obtained at 230 volts d.c. from two rotary converters.—James Thompson, in *Industrial Engineer*, January, 1927.

Changing Trends in Scrap Trade

Changes in production, marketing and consumption of iron and steel during the last few years are, briefly:

1. An increase in the supply, thereby eliminating the shortages which have come at periodic intervals in the past with resultant sharp rises in prices.

2. A slow but steady development of contractual relations between producers and consumers, whereby scrap is shipped direct to the user without the services of a middleman or broker.

3. Changes in grading of scrap and in mill practices with the result that some grades formerly in demand for one purpose are now being diverted to other purposes; the utilization by steel plants of lower grades of material that were hitherto considered unsuitable for use.

4. High freight rates have had a considerable effect in changing channels of scrap movements from producer to the consumer. Water shipments from the Pacific Coast to the Atlantic Coast and from Duluth to Buffalo on the Great Lakes have been among the developments along this line.

5. Narrower price fluctations have given the smaller yard dealer in scrap less opportunity for speculative profit, and the result has been the elimination of some dealers and the closing down of numerous scrap yards, with signs pointing to the eventual concentration of scrap business in more efficient hands.

6. The probability that the larger consumers of scrap will demand more careful preparation and selection by yards or producers in an effort to bring about lower handling and operating costs in the open-hearth plant and blast furnace, thereby putting scrap more nearly on the basis of a manufactured commodity than at present.—*Iron Age*, Jan. 6, 1927.

The Value of Proper Lighting

Colors and lights have an effect, for good or ill, on every human body. They have an effect upon us not only through the eye, but through the nerves and body. This is an important point to realize. Plants have no eyes, but nobody will deny the fact that a plant deprived of light and color will soon die. The same is true of human beings.

Light and color have three qualities —hue, tone, and saturation. If people had knowledge of why certain colors have an influence upon the eye and upon the organisms they could use this knowledge of harmony and counterpoise to produce harmonies just as the musician does with sound. The hue of light is the quality of color, and tone is the light and shade variation. Saturation occurs at only one point in every color, and adding more white to it decreases the light which makes that color, producing what are known as tints.

There is a natural order which gives harmonious color. What is called normal daylight has a tinge of yellow, a tinge of blue, and a tinge of gray light. Light changes according to the medium through which it goes, and there is very little ultra violet light in smoky cities. With direct lighting, diffused lighting, colored lighting, and illuminated shadows the expert can produce effects that nature will not do. People who buy goods from a highly illuminated store are sometimes disappointed when they get them home because they do not appear the same.

Saving money on lighting is usually a mistake. We are often too stingy with lighting, and do not install sufficient current, simply because we have never thought about it.—W. G. Raffe, in *The Electrical Times* (London), Dec. 30, 1926.

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Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Four-and-a-half Million Motor Vehicles

AUTOMOBILE production and registration figures for 1926 are interesting in several ways. Production figures are given as a little below 4,500,000 cars and trucks. Of these about half a million were exported.

Registration for 1926 in the United States was a little over 21,500,000 cars and trucks, an increase of 1,750,000 over 1925. Deducting the increase in registration from the production shows that 2,750,000 of the cars and trucks were replacements of older vehicles, which were scrapped for various reasons. In other words the replacement market alone was 2,750,000 cars and trucks, so that, even if the saturation point has been reached, the automobile industry can look for an outlet for this number.

Similarly, many replacements in the shop equipment of automobile plants may be expected.

Facts About Machinery

MASTER workmen in all ages have produced work that was admirable from many points of view. Whether it be hand wrought silver of exquisite design, furniture of graceful contour, or iron work of pleasing lines, the maker whose hand and brain made it possible deserves full credit. There is nevertheless much wasted sentiment and loose thinking in connection with these examples of fine handwork.

Too many sigh for the good old days when the craftsman worked at his ideas in wood or metal and expressed his individuality in various ways. Idealists dream of a Utopia where all may find self expression in working out their own creations with their hands and without the aid of that modern Moloch—machinery. "Hand-made" still stands as a hallmark of quality in the eyes of many, regardless of the fact that machine-made articles can be, and are for the most part, more accurate and more reliable in every way than anything even the rare master workman can produce by hand.

Much of this talk is pure and unadulterated bunk. Aside from the inability of hand labor to produce what we need at a price that we could pay, much of the vaunted hand work will not bear close inspection. The workmanship on the average family heirloom furniture would not pass inspection in a modern production factory.

Does it not stand to reason that properly shaped tools, guided by accurate machines, can cut surfaces more nearly round, flat or otherwise, than the same tool in the hands of any man? It is true that we are still scraping many bearings and surfaces, partly because of tradition and because we may not have designed and built the proper machine. But some of the world's best known mechanisms are practically free from the hand labor that was formerly considered so necessary in the production of a really high grade machine. The machine is not the enemy but the friend of all mankind.

Light and Eye-Fatigue

THE prevention of eye-fatigue is just as important as the prevention of efficiency in the mechanical aids to the worker. In industrial work, vision is operating as continuously as the other "machinery." We oil bearings and care for them in other ways. We can make work easier for the eyes by treating them right—by providing adequate and proper lighting to make their task as "frictionless" as possible. There is a prevalent idea that a worker can have too much artificial light upon his work. This erroneous conclusion is traceable to misuse of light.

Careful researches have shown an intensity of 100 foot-candles to be no more fatiguing than five foot-candles. But should this surprise us when we stop to think that our eyes evolved outdoors under thousands of foot-candles and that we read with comfort in the daytime upon our porch or in the shade of a tree? These illumination intensities are often hundreds of foot-candles and sometimes one or two thousand foot-candles. Considering that intensities of artificial illumination are commonly only a few foot-candles and that eye-fatigue is not a matter of intensity of illumination, the way is clear for designing lighting intensities upon a simple economic basis.

Combining Inventory and Vacations

SHUTTING down the plant for inventory in mid-winter has its disadvantages. It stops production at a season of the year when man feels most like production, and it gives the workmen forced vacations when least wanted.

Why not switch the period of inventory to the summer months, and combine it with vacations? For the man who ordinarily does not get a vacation such an arrangement would shift his forced absence to a season when expenses are not so high, and when he would derive physical benefits from the layoff. And it would concentrate the leaves of regular vacationists into one period, instead of dragging them over the whole summer season.

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Sundstrand No. 5 Rigidmil

THE Sundstrand Machine Tool Co., Rockford, Ill., has placed on the market a large size Rigidmil, designated as No. 5. This machine is identical in principle and all general respects to the present Rigidmil, which was described on page 901, Vol. 61, of the *American Machinist*, but is of a larger size to correspond to the performance of the No. 5 knee-type machines.

On this machine, as in the smaller model, the column, base and saddle are made in one integral casting to give a solid work support. The table height is 32 in. from the floor and provides a convenient loading height for the heavy class of work that this machine is designed to handle.

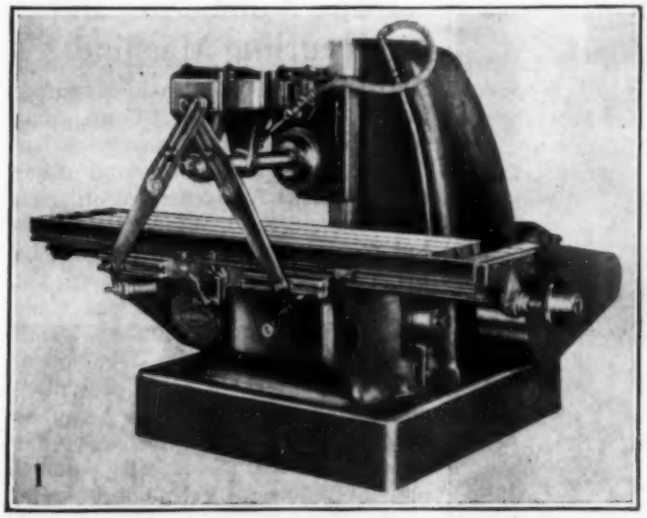
The spindle head is mounted on a wide slide, which has an improved type of gib that is said to give a solid metal support without dependence upon gib screws. Alignment is maintained by a long narrow guide. The head has a vertical adjustment of 13 in.; the minimum distance from the table to the center of the arbor is 3 in., while the maximum is 16 in. The spindle is mounted on a bronze-bushed hardened and ground steel quill, 7 in. in diam., and has micrometer horizontal adjustment for a distance of 4 in. In addition to the quill, the spindle is provided with a third bearing at the rear to support the flywheel.

The spindle head is equipped with a solid, rectangular steel overarm, 4x8 in. in cross-section. It is adjusted by means of a rack and pinion and is clamped in place by a standard diagonal clamp, such as is used on the smaller machine, which binds the overarm on all four sides.

The entire drive, from the pulley up to and including the main spindle gear, is mounted upon Timken roller bearings. The main pulley shaft extends throughout the entire width of the machine and on it is mounted a multiple-disk friction clutch and the primary pick-off gear. The secondary pick-off gear shaft carries a small bevel pinion meshing with a larger bevel gear. This second bevel gear is broached to receive the solid splines of the vertical drive shaft. Integral with this spline shaft and mounted within the spindle head is a spiral bevel pinion which drives a heavy-pitch spiral bevel gear, 14 in. in diam., mounted on the spindle shaft. Through this simplified drive, it is claimed that a liberal amount of power is supplied smoothly to the spindle. A flywheel on the spindle shaft is also used to eliminate chatter from the cutter and to smooth out the drive. The pick-off gears have integral splines cut in their bores and by means of them the spindle has a range of speeds from 70 to 180 r.p.m. All shafts and gears are made of alloy steel, hardened and ground.

The table is provided with power feed and rapid traverse in either direction, controlled by a single lever. The power rapid traverse operates at a constant speed of 150 in. per min. and is driven through a multiple-disk clutch. The normal feed range is from 3½ to 38 in. per min. By means of a compound unit and pick-off gears mounted on hardened integral spline shafts, it is possible to give a range of feed as low as ¾ in. per min. The speed unit, like the driving unit, is self-contained and bolted on the front of the machine. The entire mechanism, including the gear that drives the table screw runs in a bath of oil. Power for the mechanism is taken from the spindle drive gear box through a shaft with a multiple-disk safety clutch, which slips under excessive load. Standard lengths of feed on the table can be supplied at 42, 48 and 60 in. A saddle of unusual length and bearing area makes possible this range of feed on the standard bed without excessive overhang.

The design of the No. 5 Rigidmil was made with convenience of operation in mind and as a result very efficient control is claimed. The starting lever can be seen at the front of the machine to the right of the feed box. Rapid traverse is controlled through a lever at the center, while the vertical adjustment of the



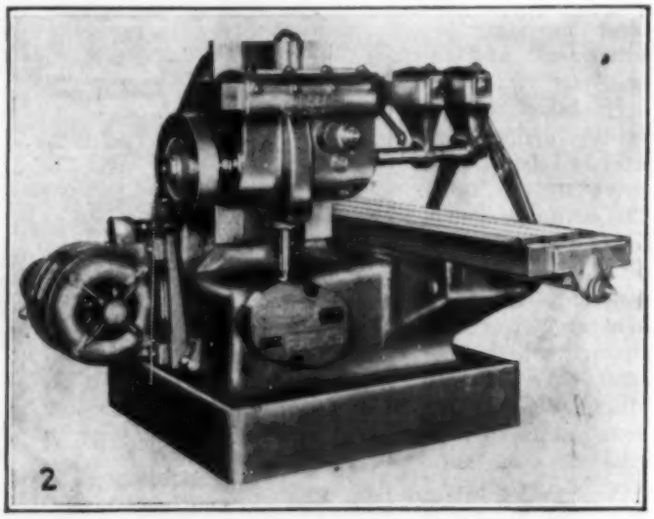


Fig. 1—Sundstrand No. 5 Rigidmil, front view. Fig. 2—Rear view of the machine.

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spindle head is made by hand lever from a position just to the left of the feed box. Feed control is regularly furnished with manual engagement for feed and rapid traverse, but can be provided with automatic operation for the rapid return of the table.

Provision has been made for delivering and handling a large amount of coolant; a geared pump having a capacity of 12 gal. per min. delivers the coolant at low velocity through a large diameter hose. By means of an ample screened pocket in the table, the coolant is returned through a trough at the rear of the saddle slide. The coolant tank in the base has a capacity of 50 gal. and when it is necessary to take care of excessive splash, a large pan can also be provided.

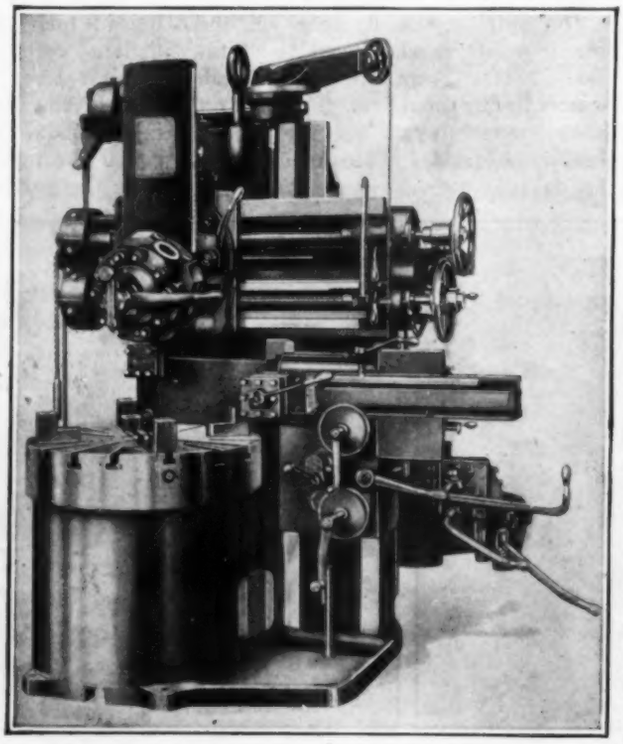
The machine can be driven from a constant-speed pulley or by motor, as shown in the illustration. The motor is mounted on an adjustable bracket hinged to the back of the machine and drives through either a belt or a chain. A 10- to 20-hp. motor is recommended.

The space required is 60x140 in. and the total column height is 62 in. The weight of the machine is approximately 10,000 lb. net.

Bullard "Spiral Drive" Vertical Turret Lathes

THE Bullard Machine Tool Co., Bridgeport, Conn., announces an improved series of vertical turret lathes to be known as the "Spiral Drive" type. This series supercedes the previous "New Era" type and embodies several improvements which have made the change in name desirable. Some of the more important improvements include changes in the material of construction, the most notable being the all-steel main slide and turret. The turret locking mechanism has been redesigned, and other detailed changes have been made throughout the machine to increase its strength and efficiency. The most important improvement, and the one from which this series takes its name, is the adoption of spiral bevel gear drive to the table. The advantages cited include a smoother table action, more constant transmission of power and, therefore, a steadier table drive without vibration. The spiral gear tooth also increases the tooth strength for proportional pitch. The design provides a pinion amply supported with a wide bearing on either side and a table gear of the largest permissible diameter for each size of machine. The gear is built in as an integral part of the table, spindle, and chuck unit. The standard Bullard method of lubrication is used to assure a constant flow of oil at different points as in previous models.

The spiral drive series includes not only the four sizes of this machine previously built, namely, the 24-, 36-, 42-, and 54-in. sizes, but also a larger 64-in. size. The design of this size follows the general lines carried out in the other four sizes. The capacity, however, provides a clear swing of work 66 in. in diam and a clearance height of approximately 34 in. under the crossrail and 48 in. under the turret face. This model is furnished with a plain table having parallel and radial T slots, and the standard equipment includes four independent faceplate jaws with a drop-forged steel body, special alloy-steel moving parts and a differential actuating screw.



Bullard "Spiral Drive" Vertical Turret Lathe

Twelve table speeds are available, ranging from 2½ to 43 r.p.m. The speeds are selectively obtained through two systems of sliding gears and controls that interlock with clutch and brake.

Both the main head and the side head are provided with eight positive and independent changes of feed and the means for adjustment and control are within easy reach of the operator when he is standing in a working position.

The large size machine is particularly adaptable to large work requiring boring, turning, and facing operations and its design permits the effective use of both heads simultaneously. This machine has a net weight of approximately 28,000 lb., and occupies a floor space of 10 ft. 6 in. square. Its maximum height for full extended capacity is 11 feet.

Noble & Westbrook Automatic Numbering and Knurling Machine

The Noble & Westbrook Manufacturing Co., Hartford, Conn., has recently developed a machine for marking serial numbers and other special marks for identification, such as dates and the like, and for knurling the border on small rings. The particular equipment shown in the accompanying illustration was made for marking and knurling small rings used for pigeon leg bands. The same machine with a similar numbering head combination can be used for marking various other small cylindrical pieces, with a serial number followed by a name or date, as the case may be.

The machine illustrated is largely

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a standard machine but it is fitted with a special automatic numbering head designed to mark the parts as they are placed on the mandrel. The numbering head is arranged so that it will put a serial number on the periphery of the ring, also the identification marks and date. This marking is followed up by a tool that knurls the edge of the ring. When the operation is completed the ring is automatically ejected from the supporting pin onto a needle, which keeps the rings in order so that they can be strung on string or wire in correct sequence.

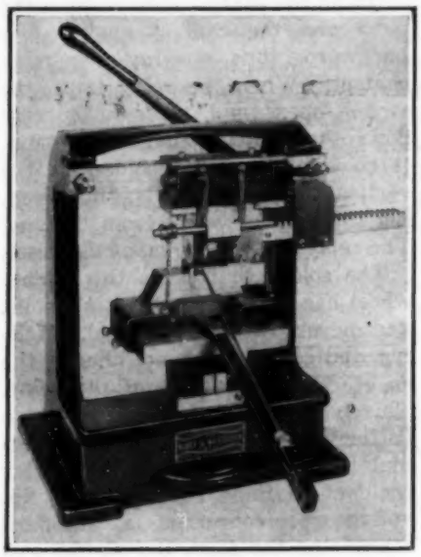


Fig. 1—*Noble & Westbrook Automatic Numbering and Knurling Machine*

The operation is simple and rapid. The operator is only required to place the rings on the mandrel and pull the lever handle, so that a large production can be obtained.

The numbering head itself is shown in Fig. 2. Special pawls for operating the consecutive numbers through the lever can be seen.

The complete machine including numbering head weighs 75 pounds.

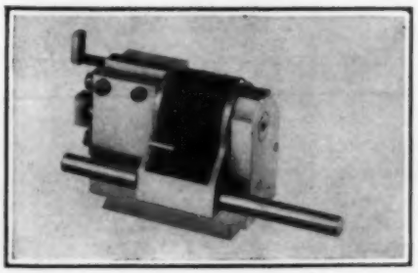


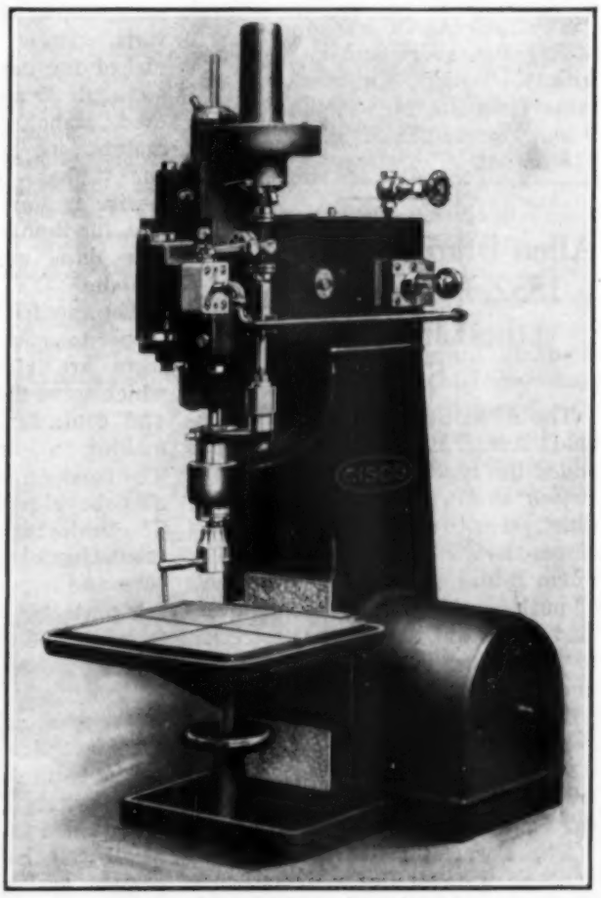
Fig. 2—The numbering head

Cisco Automatic Tapping Machine

TO MEET the requirements of manufacturers who have quantity production work in which tapping operations are required, the Cisco Machine Tool Co., Cincinnati, Ohio, has added to its line an automatic tapping machine which will be built in two sizes. At present the smaller machine, which is shown in the accompanying illustration, is being manufactured. It has a capacity for taps up to $\frac{1}{2}$ in. in diam. in steel. The larger machine, which is soon to be placed in production, will have a capacity for taps up to $\frac{5}{8}$ in. in diam. in steel.

The operation of this machine is fully automatic, the tap being fed into the work to a predetermined point, reversed, and backed to the starting point when its direction of rotation is again reversed and the tap fed down. This cycle continues without interruption and, as a result, the operator is free to use both hands for delivering the work to the machine and removing the tapped pieces. Where the nature of the work lends itself to such a method, suitable mechanism can be applied to the machine for the mechanical handling of the work by means of a magazine, revolving table, conveyor or some similar mechanism. The construction of the unit is such that during the period when the tap is being advanced into the hole and withdrawn, it is only necessary to hold the work against rotation, no holddown clamps being required. The machine is built in a bench type only and with a single spindle. A combination of spindles in line, spaced around a circle or disposed in any other manner necessary to take care of the simultaneous tapping of more than one hole in the same piece, can be obtained special. The tap may be driven at 1,000, 2,000 or 3,000 r.p.m. and its movements at all times are under positive control, including the feeding of the tap into the hole and its withdrawal. The lead screw and nut employed for this purpose is $2\frac{1}{2}$ in. long, and, as it is necessary for the pitch of the screw to be in proportion to the lead of the tap being used, provision is made for the rapid changing of lead screws when required.

Reversal of the direction of spindle rotation is accomplished by means of an air cylinder which will operate under any pressure above 25 lb. per sq.in. The control valve is located at the side of the machine and is operated by a nut on the lead screw, the position of which may be adjusted to assure reversal within 0.001 in. This construction is said to eliminate the breakage of taps in blind holes and at the same time as-



Cisco Automatic Tapping Machine

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sures the cutting of a full thread to the bottom of the hole. Provision is made to automatically compensate for any wear that may develop. Safety devices are employed to prevent the tap breaking should the operator fail to locate the hole to be tapped directly under the spindle. The maximum stroke of the machine is 1½ in. and the minimum is ½ inch.

A removable knee-type table is employed. Special fixtures can be substituted for handling certain classes of work.

A ½-hp. motor is regularly furnished for the drive and is built into the base of the machine. Power is delivered through cone clutches, which are mounted on ball bearings. These clutches are controlled by an air cylinder and are operated through the reversing valve to alternately supply the pressure on either side of the piston as required. Ball bearings are used throughout the machine.

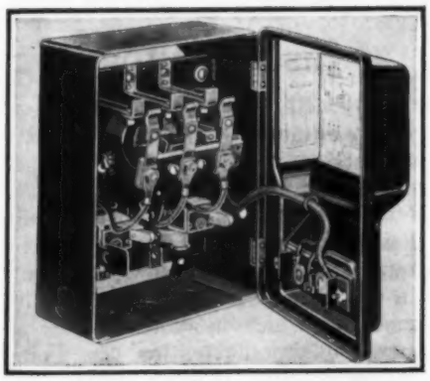
The spindle is made of alloy steel, ½ in. in diam. and is machined to fit the positive chuck. It is also fitted with ball bearings in the sleeve, and is driven by cone clutches.

The table has a working surface of 11½ in. square and is furnished with two T-slots. The maximum distance from the table to the chuck is 6 in. The weight of the machine is 415 lb. net.

Allen-Bradley Type No. J-1552, Form B, Across-the-Line Starting Switch

The Allen Bradley Co., 286 Greenfield Ave., Milwaukee, Wis., has added the type No. J-1552, Form B, switch shown in the accompanying illustration to their standard line of across-the-line starting switches. The Form B size extends the advantages of push-button control, thermal overload relays and no-voltage protection to the smaller sizes of motors which heretofore have been started only with knife switches. The type J-1552, Form B, switch is made for motors up to 1½ hp., thus bringing fractional-horsepower motors within the range of push-button operation.

The Form B switch has the advantage of small size as it measures approximately 8 in. high, 6 in. wide and 4½ in. deep. Form B-1 switch is equipped with a start and stop push button in the switch cover, as shown in the illustration. The Form B-2 switch is without push buttons, while the Form B-3 switch has a two-way lever switch for automatic hand control. More specifically these switches are designed for starting single-phase motors up to ½ hp., 110 volts, and 1 hp. 220 to 440 volts, and for starting polyphase motors up to 1½ hp., 220, 440, and 550 volts. These switches can be furnished for use with any frequency, although 25 and 60 cycle are considered standard. For single-phase motors, one pole is left idle, while for 3-phase motors and 2-phase, 3-wire motors four poles are used, and for 2-phase, 4-wire motors, one line does not pass through the switch.



Allen-Bradley Type J-1552, Form B-1, Across-the-Line Starting Switch

The switch mechanism employs copper to copper contacts. These contacts are riveted to flat springs which serve both as pressure springs and contactor arms in one piece, making a simplified construction. The fixed contacts are easily removable should replacement be necessary. The contactor arm comprises a rigid insulating bar attached to the armature and supporting the three moving contacts. The operating magnet is said to be quiet and efficient. The moving parts of the switch are very responsive and quick acting. The entire mechanism is easily accessible for inspection or wiring.

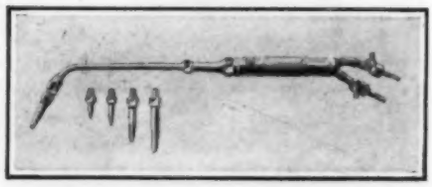
The two relays are under the magnetic switch. The relay contacts are maintained in a closed position by a small coil held firmly against the contact spring by a ratchet wheel. The ratchet wheel in turn is soldered to a vertical shaft which extends downward into the heating elements below. When the relay thermal element carries an overload current, the element becomes hot and heats the vertical ratchet shaft. When the shaft becomes sufficiently heated, the solder melts and the ratchet wheel turns on the shaft. This releases the pawl and the contact spring flies backward, thus opening the relay contact. When the relay trips, the switch opens and, since no current flows through the thermal element, it cools off and the solder on the vertical shaft again sets, thus keeping the ratchet wheel from turning. The relay can now be manually reset.

The solder that holds the ratchet wheel has an accurate melting point and never requires renewal. Melting and setting does not change the accuracy or reliability of the relay. This type of relay is said to provide better protection than fuses or thermal links and eliminates the delay incident to their replacement. No-voltage protection is a standard feature of the form B-1 switch and with the form B-2 switch it is used with a 3-wire push button. No-voltage release is provided by forms B-2 and B-3 switches with 2-wire pilot control.

Presto-O-Weld W-101 Blowpipe

The outstanding feature of the Presto-O-Weld W-101 blowpipe, manufactured by the Oxweld Acetylene Co., 30 East 42d St., New York, N. Y., is that it is designed in such a way that the oxygen and acetylene enter the inlets at about equal pressure. The gases pass through a simple mixing chamber, which is said to produce intimate mixing of the gases under all working conditions, so that waste of gases is eliminated and the time of operating and maintaining a neutral or working flame is saved. Economy of gas consumption is also claimed.

The blowpipe is made entirely of



Presto-O-Weld W-101 Blowpipe

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brass and is simple in design. It is screwed together on metal-to-metal seats, with no soldered or packed joints. It can be easily disassembled when minor repairs are necessary.

Stems for the W-101 blowpipe are made in three lengths, 4, 9 and 19 in. Each length in turn is made in three angles, 45, 60 and 90 deg. By unlocking one union nut, the operator can fit any one of these stems to the handle part of the blowpipe. This feature is said to greatly increase the adaptability of the blowpipe to the physical peculiarities of the work in hand, and to the preferences of the operator. The overall lengths of the blowpipe with different stems are 15, 20, and 30 in., respectively.

The ten interchangeable tips offered with the blowpipe have been made to withstand severe service. Tips Nos. 3 and 4 are made of heavily copper-plated brass, and tips Nos. 5, 6, 7, 8, 9, 10, 11 and 12 are made of solid drawn copper. In order to simplify the work of the operator, the proper oxygen and acetylene pressures to be used are stamped on each tip. Two stems, the 4- and 9-in., 60-deg. angle, and five tips, Nos. 4, 6, 8, 10 and 12, are furnished standard with the blowpipe. Other stems and tips are furnished special.

The blowpipe itself is sturdily constructed for severe service and is well balanced, the center of gravity being well toward the rear. The handle is knurled, to afford a firm grip. It is adaptable for any welding job from light sheet metal to heavy castings.

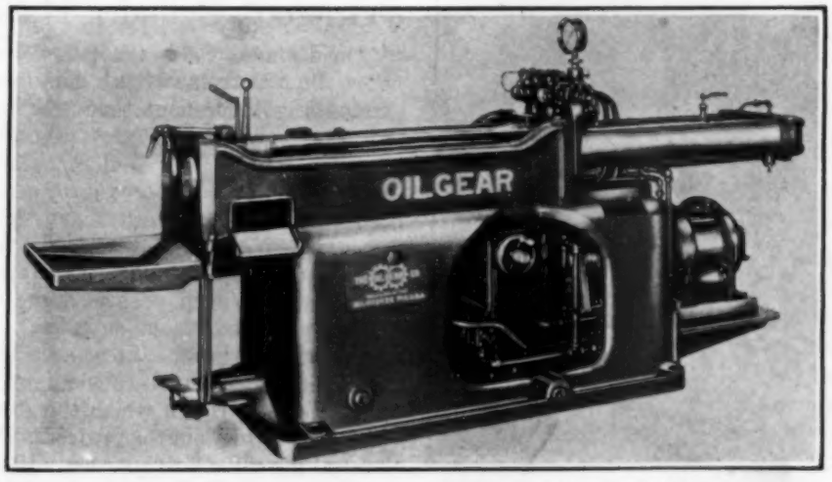
The entire W-101 welding outfit includes one type R-101 oxygen regulator equipped with 100- and 3,000-lb. gages, one type R-103 acetylene regulator equipped with 30- and 350-lb. gages; one 12½-ft. length of ¼-in. green oxygen hose with standard I.A.A. couplings; one 12½-ft. length of ⅜-in. red acetylene hose with standard couplings; one pair of No. 6 fibre goggles, the necessary wrenches, and an instruction booklet. Cutting blowpipe C-101 can also be supplied with heads of 75- and 90-deg. angles.

Oilgear "Twin Ten" High-Speed Broaching Machine

THE Oilgear Co., Milwaukee, Wis., has placed on the market an addition to its line of hydraulic broaching machines, known as the "Twin Ten." This machine has two spindles, and in operation, while one spindle is on the working stroke, the other is on the return stroke. With this arrangement it has been demonstrated that the production of the machine is largely limited by the speed of the operator, rather than by the speed of the machine.

The stroke is adjustable from 6 to 36 in., and the speed is adjustable from 48 to 360 in. per min. The normal pulling capacity of the "Twin Ten" is 10,000 lb. with a maximum pulling capacity of 12,000 lb. The machine is especially adapted for high speed broaching on small and medium sized parts. It is capable of making about five hundred 36-in. strokes per hour, or about nine hundred 18-in. strokes per hour. It is arranged for both hand and double foot pedal control.

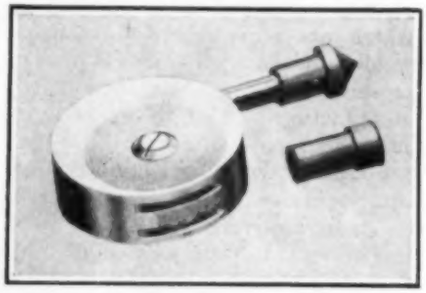
This broaching machine is a complete unit and requires no additional pumps or accumulators. Like other Oilgear broaching machines, it operates on the hydraulic principle. The oil pressure is obtained from a Type W oil pump, which is an integral part of the machine and which can be driven from any lineshaft or belted to a motor.



Oilgear "Twin Ten" High-Speed Broaching Machine

Brown & Sharpe No. 746 Vest-Pocket Speed Indicator

Four claims are made for the No. 746 vest-pocket speed indicator, illustrated, made by the Brown & Sharpe Manufacturing Co., Providence, R. I. It is simple in construction, since it has only four major parts; is light in weight—1¼ oz.; is accurate, and moderate in price. Because of the simple construction it is said to give long satisfactory service. There are no delicate adjustments to get out of order and the parts are made rugged to give maximum service.



Brown & Sharpe No. 746 Vest-Pocket Speed Indicator

The instrument consists of an indicator shaft having at its end a rubber nose for applying to the machine and a worm thread that engages a rotating drum having graduations from 1 to 100 on its periphery. The drum is mounted on a stud of ample proportions and carries on its face a knob which engages during each revolution a depression in a flexible steel disc on the side of the instrument.

To operate, the graduation is set at zero, and the operator places his

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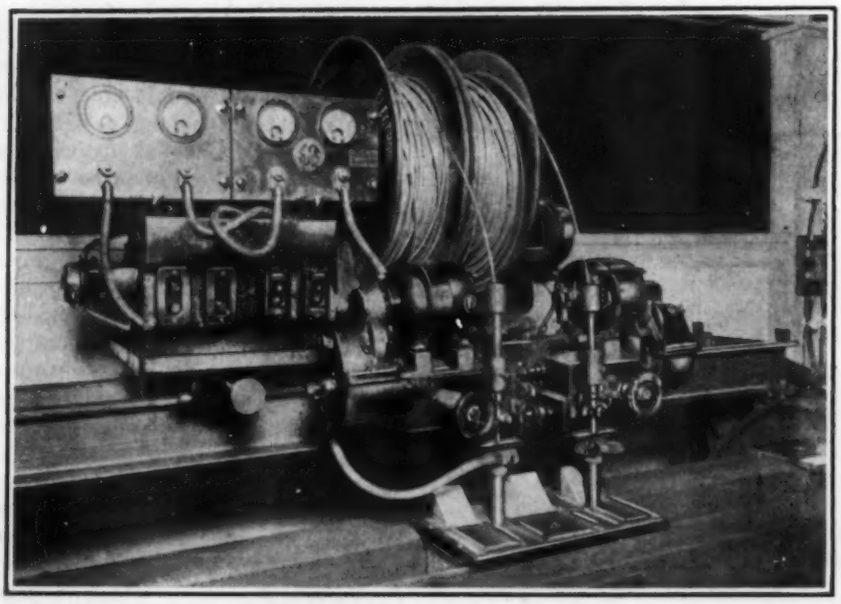
thumb directly on the small dent on the steel plate and applies the rubber point to the center of the wheel or shaft whose revolutions are to be determined. Every hundred revolutions the steel plate lifts beneath his thumb as if breathing. It is only necessary, therefore, to count the number of lifts for one minute and then multiply by 100. To this is added the number of units which appear in the slot at the top of the machine. If the r.p.m. are less than 100 the reading at the top will give the r.p.m. direct.

General Electric Duo-Arc Automatic Welder

It is claimed that with the Duo-Arc automatic welder made by the General Electric Co., Schenectady, N. Y., the welding of heavy plates is now possible at ten times the speed obtained with the single-arc manually controlled process. The machine consists of a standard travel carriage on which are mounted two automatic welding heads, and two reels of electrode wire. With this equipment, the manufacturers claim, the operation is just as simple as that of the single-arc travel carriages. One attendant can supervise the two welding arcs as easily as he can one arc.

The welder is of particular value in butt welding heavy plates. This is accomplished by the two electrodes working one behind the other simultaneously. Thus the necessarily large quantity of metal required to fill up the seam is deposited in practically one-half the time that would be required for the travel of one electrode, since the ordinary method of depositing the required thickness of metal in welding heavy plates is to weld twice with a single electrode over the same seam. An electrode larger than ¼-in. in diam. is not commonly used for high-grade work because the deposition of metal cannot be accurately controlled and it is inconvenient for operators to handle the large amounts of necessary electrical energy concentrated in a single arc.

For welding half-inch plate, the seam is prepared by beveling to an angle of 30 deg., total opening. With electrodes $\frac{3}{16}$-in. in diam. and approximately 250 to 300 amp. in each arc, a speed of welding of from 5 to 7 in. per min. may be obtained. The resulting weld is of high quality because of the decreased chance of burning the weld.



General Electric Duo-Arc Automatic Welder

Stow Power-Driven Screw Driver and Drill

The Stow Manufacturing Co., Inc., Binghamton, N. Y., is marketing a power-driven screw driver and drill unit for use with flexible shaft equipment. The tools are shown in Fig. 1. When motor driven, any standard motor for use on any commercial circuit can be supplied. Belt drive from a countershaft as shown in Fig. 2, can also be obtained.

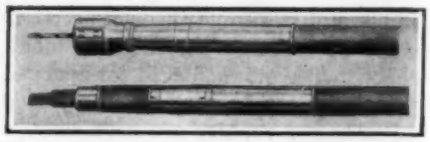


Fig. 1—Stow Power-Driven Screw Driver and Drill

The drive unit may be suspended from the ceiling or in the case of the motor-driven type mounted on a floor stand. The flexible shaft is said to be well constructed of the best materials available.

The tools themselves are counterbalanced so as to relieve the operator of any unnecessary strain. Both the screw driver and the drill unit are made of high-grade tool steel. The screw driver has a clutch incorporated in its construction that slips when the screw is driven home. The clutch may be adjusted so that the screw can be driven at any desired

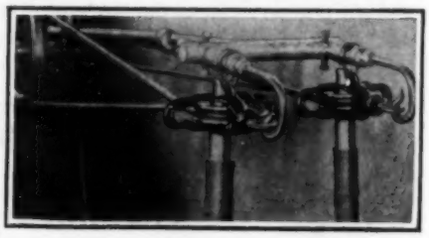


Fig. 2—Flexible shaft driven from countershaft

amount of torsion. A sliding sleeve is provided for centering wood screws.

The tool is built in two sizes. The smaller will drive screws up to No. 14 size; the larger, sizes above No. 14 wood screws.

"Grisaco" Cylinder Hone

The Grinder Sales Co., 526 West Fort St., Detroit, Mich., has perfected a cylinder hone that uses one set of stones for all sizes of bores ranging from $2\frac{3}{8}$ to $4\frac{1}{2}$ in. in diam. Different sizes of bores are taken care of by screwing different length pins in the holders in which the stones are die cast. The stones are all 4 in. in length. Three-stone or six-stone hones can be supplied.

As shown in the cross-sectional illustration, the tool consists of a hollow shell through which the stone pins of varying lengths project. The conical pin ends bear against adjustable cones mounted on a screw within

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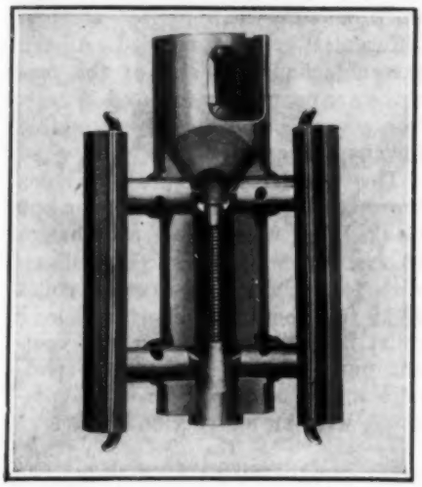


"Grisaco" Cylinder Hone, sectional view

the shell by means of which the hones can be advanced. A range of adjustment of ¼-in. in diameter is available. The stones are kept from falling out by means of coil springs that are slipped over the prongs at their ends.

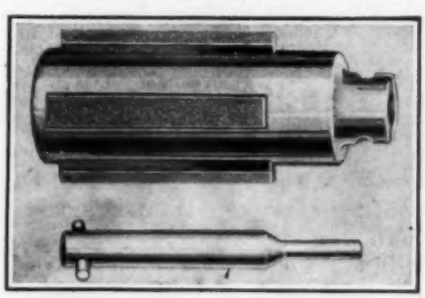
The tool may be driven by any standard ⅜-in. portable electric drill.

Hall Burnishing Tool for Hydraulic Brakes

The burnishing tool shown is for removing the corrosion and sediment from the master and wheel cylinders of hydraulic brakes. It is being made by the Hall Manufacturing Co., Toledo, Ohio.

This burnishing tool is made in three sizes, with ranges of 1⅛ to 1⅛ in., 1½ to 1⅝ in., and 1⅞ to 2¼ in., respectively. The two smaller sizes are of the three-stone type, and the largest is of the four-stone type. The stones are actuated by individual springs from within the tools, and, while they are easily removable, it is said that they cannot fall out until released by unscrewing the head of the tool.

Besides being used for burnishing hydraulic brake cylinders, this tool may be satisfactorily employed for burnishing, polishing and enlarging holes in cast iron, aluminum, bronze and hardened steel.



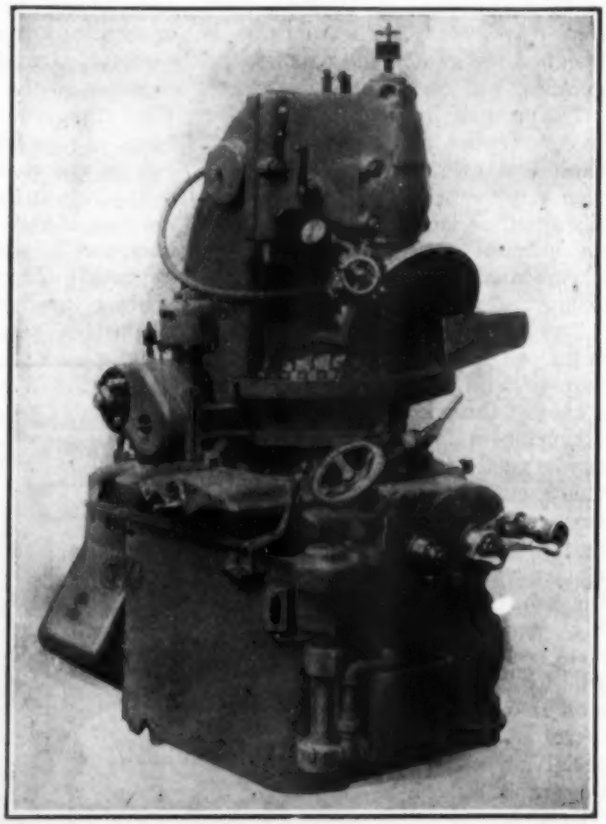
Hall Burnishing Tool for Hydraulic Brakes

Gleason 12-Inch Automatic Wet Cutter Sharpener for Spiral Bevel Gears

THE 12-in. automatic wet cutter grinder for spiral bevel gears, shown in the accompanying illustration, was recently placed on the market by the Gleason Works, Rochester, N. Y. The unit is completely self-contained and power for driving the grinding wheel, table indexing mechanism, and water pump is supplied by three separate motors. The grinding is performed on the conical side of a wheel 14 in. in diam., which is carried on a ball bearing spindle. Power is transmitted to the wheel spindle through spiral bevel gears from a vertical shaft having a belt drive from a 3-hp. motor mounted in the base of the machine. A ¼-hp. built-in type motor is used for operating the indexing mechanism and another motor of similar type is used to drive the coolant pump which has a capacity of 12 gal. per minute. On this machine the cutters are rough sharpened by taking twelve grinding cuts in quick succession on each blade. Fifteen sec. are required for this operation on each blade before the indexing mechanism places the next blade in position. During the indexing motion, the table is automatically moved back 0.012 in., so that each succeeding blade is presented to the wheel from the same starting position. The index is of the stop-wheel type and turns the work the correct amount necessary for cutters having both inside and outside blades or for cutters having either all inside or all outside blades.

After the rough sharpening operation, a clutch is shifted to engage a different part of the feed, so that the cutter passes across the wheel and back only once and the index feeds in approximately 0.001 inch.

By grinding on the conical side of the wheel, line contact is obtained and unnecessary burning of the blade is avoided. The finish is fine due to the means of dressing the wheel and to the fact that the feed of the work is moderate. The line contact principle is the same as universally used in sharpening hobs. The advantages looked for in this machine are more gears per grind per cutter since there is less chance for burning the blade, less waste in grinding away of the cutting tools, and the possibility of one man oper-



Gleason 12-Inch Automatic Cutter Sharpener for Spiral Bevel Gears

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ating two machines simultaneously.

The cutter holder is adapted for three sizes of cutters, namely cutters 6, 9 and 12 in. in diam. The cutter holder has a cradle base for tilting to different angles as required for sharpening cutters of different blade angles. The tangent of the angle for setting is equal to the sine of 20 deg. times the tangent of the blade angle. By means of graduated dials, the table can be offset so that in combination with the tilting of the cutter, exact location is obtained for accurate sharpening.

The two hand-operated dry cutter grinders built by this company will be continued.

Pfauter No. 11 Automatic Horizontal Hobbing Machine

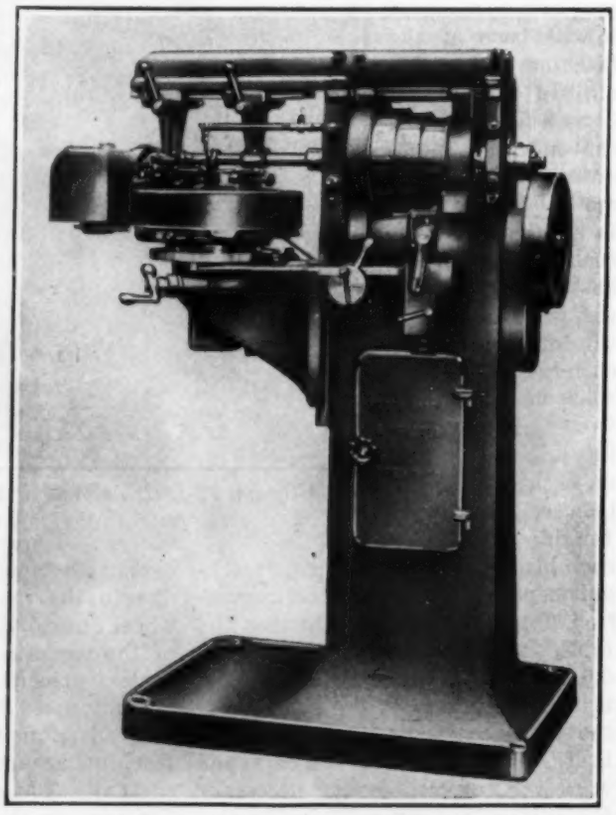
THE No. 11 Pfauter automatic horizontal hobbing machine shown in the accompanying illustratin is being marketed in this country by O. Zernickow Co., 15 Park Row, New York, N. Y. The machine is designed for generating small spiral spindles, and spur and spiral gears.

The machine has been designed for precision work and the box column, knee, and overhanging arm are of such ample proportions as to prevent vibration or distortion under even the heaviest cuts. The coolant tank is embodied in the base of the machine.

The main drive is by cone pulley from an overhead countershaft. By means of three steps the cutter revolutions can be varied to provide a cutting speed most suited to the nature of the material and the size of the hob. The dividing gear drive consists of a worm-wheel of high precision in pitch and a worm of special material mounted in a dust-proof oil bath. The drive is taken from the cone pulley shaft and then through the index change gears to the dividing worm shaft, so that the cutter spindle and the work rotate in correct relation to one another and the indexing is automatically effected. The machine is especially designed for work of a particular nature, such as small spiral spindles with few teeth for separators, gramophones and clockwork. The pieces to be hobbed are mounted horizontally and are held between centers or by means of a draw-in collet. The work table travels in a swivelling slide mounted on the knee of the machine. With this swivel arrangement the blank can be set at any angle to the hob by means of a graduated scale, and spirals up to 80 deg. can be cut. In the case of very small diameter work a support is placed under the cutter to prevent deflection.

Since this hobber is essentially a production machine, the range of work is somewhat limited and no differential gear is provided. All the external change wheels of the machine are completely inclosed in cast-iron covers, but are easily accessible for changes.

The regular equipment includes the necessary change wheels for one blank, the requisite feed change wheels, one hob arbor $\frac{3}{4}$ in. in diam. with four rings, one draw-in collet of 19 mm. bore, one short and long collet bushing, a countershaft, coolant pump and the necessary spanners and special parts for the machine, with an instruction booklet.



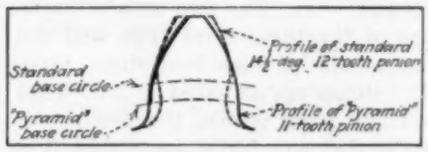
Pfauter No. 11 Automatic Horizontal Hobbing Machine

SPECIFICATIONS

Height of centers, in.	$1\frac{9}{16}$
Maximum length of tooth face to be hobbed, in.	$5\frac{11}{16}$
Maximum spindle diameter, in.	$1\frac{3}{16}$
Maximum hob diameter, in.	$1\frac{9}{16}$
Number of teeth to be hobbed	2—100
Maximum length of hob, in.	$2\frac{3}{8}$
Maximum pitch to be hobbed, D.P.	$12\frac{1}{2}$
Speed of hob, r.p.m.	275, 230 and 190
Speed of overhead countershaft, r.p.m.	460
Minimum axial distance between hob arbor and work arbor, in.	$\frac{3}{16}$
Maximum axial distance between hob arbor and work arbor, in.	$1\frac{3}{16}$
Power required, hp.	1
Floor space of machine, in.	28x20
Weight, lb.	1,200

Boston "Pyramid" Gears

A line of standardized gears embodying an improved tooth form has been placed on the market by the Boston Gear Works Sales Co., Norfolk Downs (Quincy), Mass. This tooth form, which is known as "Pyramid," is especially adapted for pinions where heavy duty is demanded. The tooth form should be used for pinions of 16 teeth or less. Such pinions are interchangeable with any standard Boston pinions of the same pitch and pitch diameter, but the Pyramid pinion must have one tooth less than the gear that it


Standard base circle
"Pyramid" base circle
Profile of standard 14½-deg. 12-tooth pinion
Profile of "Pyramid" 11-tooth pinion

Comparison of "Pyramid" Tooth Form with 14½-Deg. Involute Tooth Form

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is to replace, since the base circle is smaller in diameter.

The characteristics of this tooth form are a wide base of tooth and the elimination of undercut, which is ordinarily present in the standard 14½-deg. gears of small tooth numbers. The illustration shows a comparison of the tooth forms. Because the undercut is eliminated, a longer active working surface is available with resultant increase in life. Because of its shape, greater strength is claimed for this pinion.

Cincinnati Self-Contained Universal Grinder

A LINE of self-contained universal grinders ranging in size from 12x24 in. to 16x72 in. has been placed on the market by Cincinnati Grinders Incorporated, Cincinnati, Ohio. Individual electric motor drive is furnished to the headstock, grinder spindle, and table traverse mechanism, and centralized control is provided for all movements. These self-contained universal machines are practically identical in dimensions and range with the regular countershaft type of universal machines made by this company.

The headstock is driven by a variable speed d.c. motor of ¾ hp. The motor is for operation on a 230-volt circuit and the speed may be adjusted from 600 to 1,800 r.p,m. by means of a rheostat mounted on the front of the machine in proximity to the wheelhead push-button control station. The motor is mounted directly upon the headstock and drives by means of a silent chain and worm. The sprocket is mounted directly on the worm shaft and the latter in turn transmits the power to the wormwheel, to which the drive plate is fastened. The worm is made of steel, hardened and ground, and the wormwheel is made of hard bronze. The latter is partially submerged in oil and, as it revolves, carries the lubricant to the worm, which drives it. Provision for taking up the chain to compensate for wear is made in endwise adjustment of the motor frame on the headstock housing.

The drive to the wheel spindle is furnished by a 5-hp. constant-speed motor rotating at 1,700 r.p.m. The connection between the motor and the pulley on the wheel spindle is made through an endless belt which runs over a spring-tension idler to compensate for belt stretch.

The drive to the speed change box for the work table traverse and to the coolant pump is by means of a 1-hp. constant-speed motor rotating at 1,150 r.p.m. While the headstock motor must invariably be of the d.c. type, the other two motors just mentioned, need not necessarily be so. They can be either d.c. or a.c. since each one is of the single-speed type.

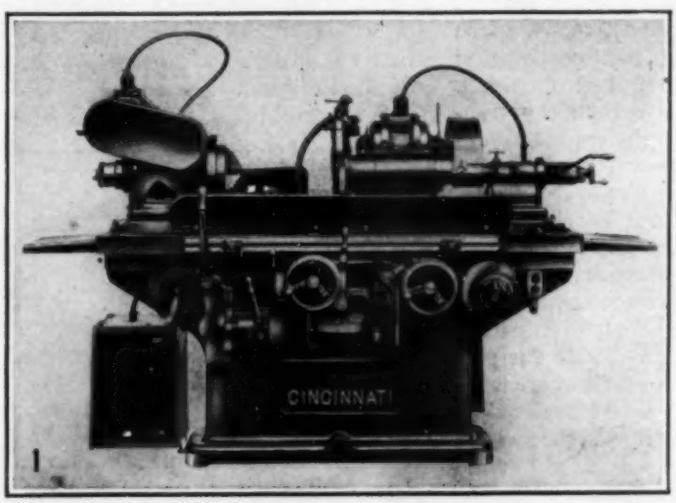
In cases where a 230-volt d.c. supply line is not available, machines can be furnished with a small d.c. generator mounted on the rear of the machine and driven by means of a shaft and a flexible coupling from the same motor that serves to drive the table gear box and the coolant pump. In this case, a larger motor than regularly specified is required, a 1½-hp. motor being found necessary. The generator is supplied with a voltage regulator.

The headstock is mounted on a swivel base and has a combination live and dead spindle. The equipment also includes a footstock of the combination lever and screw type; a wheel truing center and a diamond holder without the diamond or nib; an internal grinding fixture with driving belt; two wheels and wrenches; internal fixture driving pulley, table-type diamond bracket for truing internal fixture wheels; an 8-in. four-jaw independent chuck with chuck plate; a face plate and the necessary back rest; a center rest and tooth rest; one grinding wheel 14 in. in diam. by 1 in. face with a 5 in. hole; one grinding wheel mount; and one wheelguard and cover with piping and nozzle.

The 12x24-in. machine weighs 5,400 lb. net with all motors, and the 16x72-in. machine, 7,560 lb. net.

"Pee Dee Que" Screw Plates

The Wells Tap and Die Co., 107 Hope St., Greenfield, Mass., is marketing two sets of "Pee Dee Que" screw plates. Set No. 50, which is shown in the accompanying illustration, will cut five sizes of threads ¼, 5/16, ⅜, 7/16, ½ in., while set No. 60



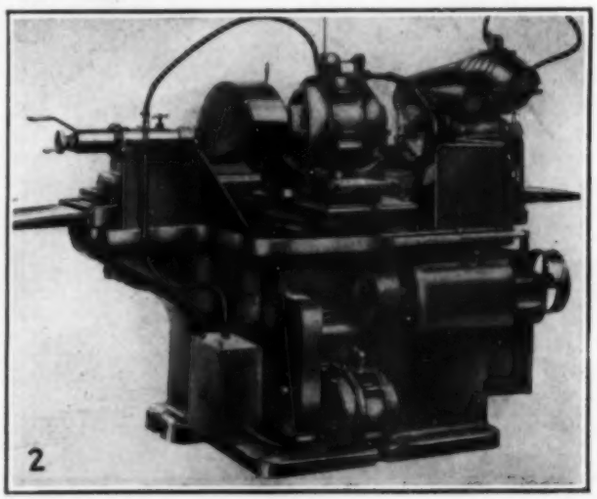


Fig. 1—Cincinnati Self-Contained Universal Grinder. Fig. 2—Rear view

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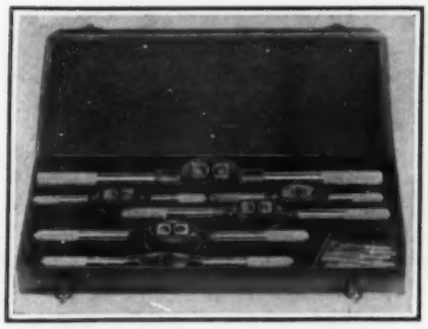


"Pee Dee Que" No. 50 Screw Plate

will cut seven sizes, the sizes just mentioned and ⅜ and ½ in. All sets have taper taps, Well's patent bevel dies, multiple stocks and an adjustable tap wrench. Each set is packed in an all-steel box.

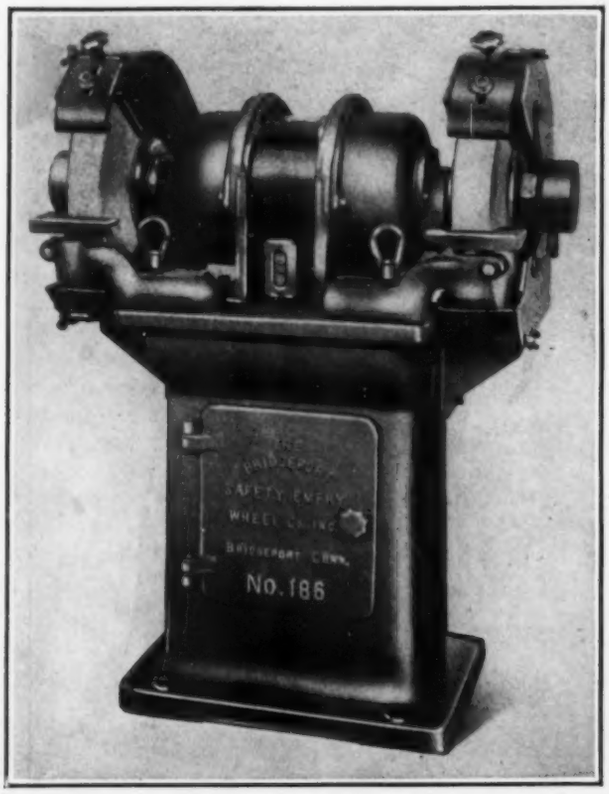
A stock is furnished for every size of die. The die is of convenient length for fast and accurate work, and thus with multiple stocks it is possible for several workmen to use the same equipment at the same time. The adjustable bevel dies are made in two pieces from drop-forged special-analysis tool steel. The dies have large chip room and ample oil cavities. The tool is free cutting and a fine, clean thread is said to result.

Bridgeport Motor-Driven Floor Grinders

THE Bridgeport Safety Emery Wheel Co., Bridgeport, Conn., has placed on the market a line of three motor-driven floor grinders, Nos. 184, 185, and 186, for general utility grinding operations under all kinds of adverse conditions. All parts have been designed to withstand abuse and careless operation.

The motors, which are built integral with the grinder spindles, are of the squirrel-cage induction type, and are furnished by the General Electric Co. These motors have been built in accordance with the A.I.E.E. specifications and are said to be thoroughly dependable.

It is claimed that the stator insulation will successfully withstand temperatures well above the limit of 90 deg. C., as well as abrasive dust, moisture, acid or alkali conditions, and foreign matter generally, which ordinarily causes breakdowns in the insulation. These motors will regularly take an overload of 25 per cent with a temperature rise of not over 55 deg. C. The spindles are mounted on carefully-fitted ball bearings, locked by individual lock nuts. The bearing housings have been designed to retain the oil and exclude grit and foreign matter. A well-known make of ball bearings is used and the sizes have been conservatively selected with regard to their load and speed capacity. Each bearing housing contains an oil reservoir of ample proportions, so that a supply of lubricant is available for considerable period of time without attention. A sight level oil cup is used for inspection of the oil and for filling.



Bridgeport Motor-Driven A.C. Floor Grinder

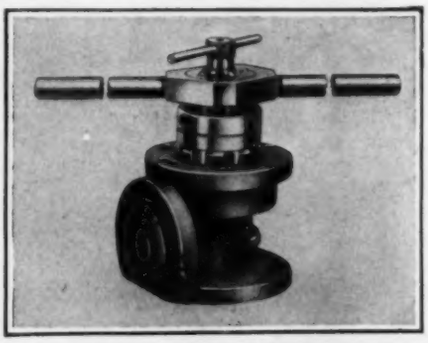
The wheel guards are made from steel plate of such weight to meet the best practice in protection against wheel breakage. An adjustable protective nose piece is also provided. These guards are fully adjustable and a nozzle is arranged at the rear for connection to an exhaust system. The outside plates of the guards are hinged in order to facilitate the change of wheels. The equipment also includes an automatic starter having overload and undervoltage protection and push-button control.

SPECIFICATIONS

Type	184	185	186
Horsepower	2	3	5
Speed r.p.m., no load	1,800	1,200	1,200
Wheel diam., in.	12x2	16x2½	18x3
Diam. of spindle at wheel, in.	1	1¼	2
Diam. of spindle in bearings, in.	1¼	1¾	2¼
Diam. of flanges, in.	4	6	7
Distance between wheels, in.	20	25	25
Size of base bottom, in.	19x17	20½x18	25x18
Overall length, in.	29½	35	37
Height, floor to center of spindle, in.	38	38	38
Net weight, lb.	660	850	1,150

Foster-Johnson Special Valve Reamer

The Foster-Johnson Reamer Co., Elkhart, Ind., has designed and built the special reamer shown in the accompanying illustration for reaming worn bushings in triple valve bodies of Westinghouse types PL.: K1-2, L1, F2, P12, H1-2, and New York type PL.: 33 C, 41 F, 42 P, 43 H, 44 S and all K types. The range of expansion is slightly under 3½ to 3⅝



Foster-Johnson Special Reamer for Triple Valve Bodies

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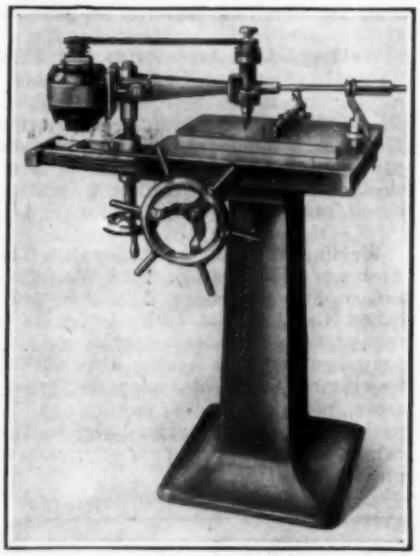
in., so that the tool can be ground a large number of times before it becomes useless.

The adjusting nut is graduated to read the amount of expansion in half thousandths. The blades are expanded parallel after being inserted to the full depth of the bushing. Every reamer is guaranteed.

Oliver Profiling Machine

In the profiler shown in the accompanying illustration, made by the Oliver Instrument Co., Adrian, Mich., the spindle is mounted on the end of a swinging arm and is free to move to any part of the table on which the work is solidly clamped. The



Oliver Profiling Machine

cutter movement is guided by hand and in addition to movements in the horizontal plane, the spindle has a limited vertical travel so that the cutter can be raised over the work to enter an opening in the center. A further vertical adjustment of the spindle to adapt it to various thickness of work is obtained by means of an adjustable supporting screw.

The swinging arm and motor are mounted on a carriage, which is moved back and forth by means of a handwheel and a rack and pinion. The handwheel controlling the traverse of the carriage can be attached to either side of the machine to suit a right or left hand operator. The entire spindle and motor drive are capable of being rotated about a center mounted on the movable carriage.

The spindle is guided and held to its work by the round rod extending from a swinging arm. A knurled grip slides on this rod and has a pinion between two collars that engages a rack attached to the table. When the direction of the cut is at right angles to the arm and the force of the cut has a tendency to move the arm, these movements can be prevented by grasping the grip. The pull of the cutter then comes against the rack teeth. This arrangement is said to give perfect control of the cutter under all conditions.

The spindle is hardened and is equipped with extra large ball bearings. The cutter is held by means of a spring collet. End mills, forced cutters, or rotary files can be used. Due to the rigid construction of the spindle and supporting members and the positive control provided, it is said that extremely heavy cuts are possible for this type of machine.

This machine can be used for die making, metal pattern making, cam cutting, engraving, embossing, profiling either horizontal, vertical, or a combination of both, stencil cutting, and routing. The operations can be performed either free hand or by means of a template. The wide range of work accomplished by the machine requires spindle speeds varying from 800 to 8,000 r.p.m. The spindle is regularly equipped with a cone giving speeds of 800, 1,600 and 2,400 r.p.m. For higher speeds a different motor pulley is used. These standard speeds are suitable for cutters varying from $\frac{1}{4}$ to $\frac{3}{4}$ in. in diam. for working in brass, iron and steel.

The table is 22 in. square and the spindle serves an area about 12x20 in. A work clamp is provided that can be adjusted for various types of work. The table height is 36 in. above the floor.

The floor space occupied by the machine is 2x3 ft. and the weight is 375 pounds.

Cleveland Crank Planers

The Cleveland Planer Co., 3148 Superior Ave., N. E., Cleveland, Ohio, has taken over the manufacture of the Woodward crank planers formerly built by Woodward and Powell Co., Worcester, Mass. The machines will be made in the 24- and 36-in. sizes only. Repair parts as well as new machines will be supplied. The regular line of Cleveland open-side planers is to be continued.

Warner & Swasey Box Chuck and Adjustable Chuck Backstops

The Warner & Swasey Co., Cleveland, Ohio, has recently introduced chuck equipment for lathes. The box chuck, shown in Fig. 1, is for holding work of awkward shapes, where rigidity and accuracy are required. It was particularly designed for small work, such as is usually found in brass shops, where it is difficult to chuck the work accurately without the use of jaws fitted to the shape of the work.

The box chuck has a double-ended screw of coarse pitch so that it is

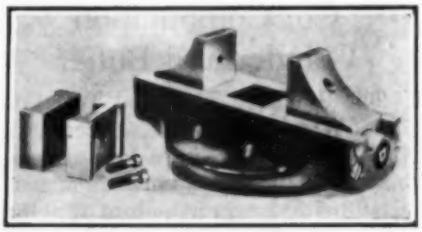


Fig. 1—Warner & Swasey Box Chuck

possible to open the jaws quickly for loading. The master jaws are made from forgings fitted with bronze bushings and are deeply anchored in the box chuck body to retain their accuracy for a long period of time. Adapters, which fit into the permanent jaws, are provided for holding the work jaws. These are finished in either the blank or the dovetail type. The flange of the chuck is recessed for face plates so as to fit the spindle of any machine.

The adjustable chuck back stops,

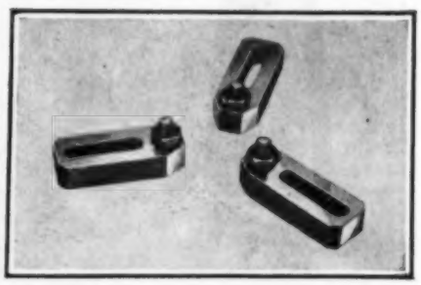


Fig. 2—Warner & Swasey Adjustable Chuck Back Stops

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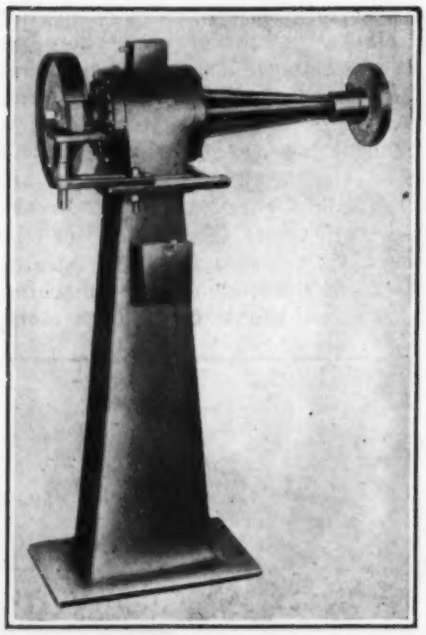
shown in Fig. 2, furnish a convenient means for locating work in the chuck endwise. These back stops are very accurate for close limits on shoulder distances and they eliminate the necessity of making special jaws, which otherwise would be required.

The adjustment provided by the back stop screws is ordinarily of sufficient accuracy for first operations, if it is desired to use them as plain backing screws. However, in second operations or operations where extreme accuracy is required, a cut may be taken on the end of the screws which are left soft for this purpose. To locate the screws on varying radii the back stops may be swiveled on the chuck face. They are held there by either tapping into the face of the chuck or by T bolts in the slots, as desired.

Standard Electrical Tool Co. Combination Grinder and Buffer

The Standard Electrical Tool Co., 1938 West Eighth St., Cincinnati, Ohio, is bringing out a line of combination grinders and buffers in four sizes, with integral motors ranging from ½ to 3 hp. The machines can be supplied for use with either a.c. or d.c. circuits.

The shaft is made from high-grade nickel steel and is mounted upon three SKF ball bearings. The motor is controlled by a quick make-and-break switch located on top of the motor housing within easy reach of the operator.



Standard Electrical Tool Co. Combination Grinder and Buffer

Trade Catalogs

Gear Reduction Units. The Farrel Foundry and Machine Co., Buffalo, N. Y., has published a comprehensive catalog on the Sykes gears and gear reduction units. Double helical gears are featured. Many gears of large size and capacity are listed, as well as small and medium sized units. Some useful engineering tables are included. The catalog is well illustrated throughout and is bound in loose-leaf form between stiff paper covers.

Motors. The Master Electric Co., Linden and Master Avenues, Dayton, Ohio, has published a small 12-page booklet entitled "Brass Tacks About Selecting Motors." This publication is the second of a series and is intended to be helpful to motor buyers in general. Seven leading questions are asked and answered in order to point out some careless buying habits.

Plug Tools. The Eclipse Interchangeable Counterbore Co., Detroit, Mich., has published an 8-page bulletin describing the Welch plug tools designed for machining cored holes to receive expansion plugs. Many illustrations are used to point out the construction of the tool and its advantages in operation.

Pyrometers. The Pyrometer Instrument Co., 74 Reade St., New York, N. Y., has issued several leaflets describing the "Pyro" radiation pyrometer, which was recently placed on the market. The publications include a reprint from the *Journal of Scientific Instruments*, in which this instrument is described.

Rebuilt Machine Tools. The Bertolette Machine Tool Co., Inc., 224 Culver Ave., Jersey City, N. J., has issued a large circular describing some of the rebuilt and new tools that it has available for sale. Many of these machines are illustrated. The line includes boring machines, planers and shapers, slotters, drilling machines, milling machines, engine and turret lathes, screw machines, gear cutters, and miscellaneous equipment.

Screws, Cap and Set. The Bristol Co., Waterbury, Conn., has published a 28-page catalog on its safety set screws and cap screws. A large number of illustrations, both halftones and line cuts, are used to point out the features of the design of these screws and their application for various types of work. The tools used with these screws are also listed, and screw tables are appended.

Sheet and Plate Machinery. The Streine Tool and Manufacturing Co., New Bremen, Ohio, has published a leaflet illustrating die-type corrugating rolls, power squaring shears, and rotary gang slitters. Some of the machines are shown in operation. A list of the users of each type is presented.

Sleeper and Hartley, Inc., Worcester, Mass., have prepared a wall chart showing the decimal equivalent of American steel and wire gages from No. 7-0 to No. 40. The chart measures 23x28 in. and, besides containing the gage data in numerals about 1 in. high, there are also shown illustrations of eleven of the universal spring coiling machine made by this company.

Tramrail Systems. The Cleveland Electric Tramrail Division of the Cleveland Crane and Engineering Co., Wickliffe, Ohio, has issued an illustrated leaflet showing Cleveland tramrail systems for handling material in process.

Welding, Arc, Accessories for. The General Electric Co., Schenectady, N. Y., has issued a 4-page pamphlet, GEA-571, on arc welding accessories. The line includes shields and helmets protective glasses, electrode holders, electrodes, welding cable, a scratch brush, and a stabilizing reactor.

Welding and Cutting Apparatus. The Alexander Milburn Co., 1416 West Baltimore St., Baltimore, Md., has published Catalog No. 72-E, which is a vest-pocket edition covering its welding equipment, such as torches, tips, outfits, regulators, manifolds, adaptors, generators, portable trucks, paint guns, oil preheaters and carbide lights. The catalog contains forty-four pages and is illustrated.

Pamphlets Received

Compensating Production Executives. The Policyholders' Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y., has published a small 20-page booklet entitled "Methods of Compensating Production Executives," the seventh in a series on the subject of compensation. It constitutes a report of a survey made in various industries. Examples of methods used and the results obtained by six large companies are explained in some detail. In addition there is generalized information.

Roller Bearings in Machine Tools. The Timken Roller Bearing Co., Canton, Ohio, has reprinted in booklet form the paper, presented at the A.S.M.E. Machine Tool Exhibition at New Haven by S. M. Weckstein, entitled "Recent Developments in the Application of Tapered Roller Bearings in Machine Tools." The reprint is well illustrated by means of cross-sectional views.

NEWS OF THE WEEK

Automotive Engineers Study Value of X-Ray in Metal Working Industry

Extensive apprentice training urged in auto building plants

THE first technical discussion of the value of the X-Ray in the metal working fields was the high spot of the annual meeting of the Society of Automotive Engineers, which was held in Detroit, Jan. 25 to 28. Practically one whole session was devoted to the presentation of a paper which endeavored to point out the value of the application of the X-Ray in obtaining accurate knowledge of the structure of materials, particularly of metals, and to show how this knowledge would be of value in the selection of metals for various purposes. The discussion brought out facts that created unusual interest among the engineers present and it is expected that this has furnished the beginning of many future experiments and researches into the possibilities of this science in the metal working industries.

The meeting, which was held in the General Motors Building, was attended by several hundred of the most prominent automobile engineers in the country. The sessions were so presented and the papers were of such general interest that a great deal was accomplished in covering important subjects.

Need of Training

A session on apprentice training opened the program. H. A. Frommelt presented a paper, "Apprenticeship in the Automobile Industry." Albert Sobey, of the Flint Institute of Technology, told of the training at the General Motors Institute of Technology. Mr. Frommelt told what was actually being done and pointed out lines for development. His plan proposes to train toolmakers, machinists, die makers, etc., to create a trained personnel that can be shifted into engineering, drafting, servicing or supervision, as needed; to stabilize the working force, and reduce turn-over; to teach sound economics as a defense against adverse doctrines and to include the servicing of cars. Mr. Sobey outlined the educational work of the General Motors Corporation in training and developing man-power for its many activities. The institute at Flint will serve as a clearing house for methods and outlines of training courses, that can best be given at local plants. He stated that hundreds of men in Flint are working their way up in the industries of that city through the opportunities offered.

The production sessions were fortunate in having both papers and speakers of unusual interest. E. J. Lowry presented a paper on "Hardness and Machinability of Grey Iron Castings," that showed extreme care in its preparation and much research to secure the data brought out. There seems little doubt that there is as yet no way of measuring either machine ability or wearing qualities by any of the known methods. They all have their place but they do not tell whether a casting will machine easily or wear well. The results of many tests were shown to illustrate that many erroneous ideas were still prevalent regarding the use of silicon, phosphorus and other elements.

In the interesting discussion that followed this paper, many facts of value were brought out. Cases were cited where an open grain iron gave the largest life in a cylinder block test. The reason advanced was that the open grain held more lubricant and also that because the grain was open there was more graphitic carbon on the surface to assist in lubrication. It was shown that a high phosphorous content lessened the growth of iron under repeated heating and that an iron with a minimum of expansion could be counted on for a long life. Tests made by superheating the iron in melting had given tensile strength up to 75,000 lb. per sq.in. In the author's opinion, the ultimate strength of iron under both tension and compression, was the best guide as to its quality. Arnold Lenz spoke of the practice of dumping castings from the mold while still red hot and felt that this practice eliminated to a large extent, the dangers of cracking in use.

Uses of Chromium Plating

W. N. Phillips followed with a paper on the "Purposes, Methods and Results of Chromium Plating," as brought out by the practice of the General Motors Corporation. This included plating both for decorative effect, as radiator shells, and for wearing parts such as piston pins, gages, etc. In gage work it is usual to plate above size and lap to the desired dimension. An aluminum wheel and a very fine abrasive is used. Jeweler's rouge is good, but slow. Plating up to 0.015 in. is possible, but for gages it averages 0.0005 in. and for decorative purposes 0.00005 in. Some gages are plated and not lapped, it being possible to regulate the thickness of the coating by varying the time of immersion, the current used and the strength of the solution. A normal rate of plating was given as 0.0005 in. per hour. Prof. Baker gave some estimated figures as to the costs of plating with chromium, which were much higher than Mr. Phillips' experience had shown in actual practice. For the usual protective and decorative coating, over nickel, he gave the cost as about one cent per square foot. To secure best results on such work as radiator shells, the chromium is plated over the usual nickel and copper. On gages and bearings it is plated directly on the steel.

Mr. Phillips pointed out that owing to the plate being very thin, good results could not be expected on soft metals such as untreated gear teeth, as the metal under the plate would crush and fail to maintain its form. Chromium plated cutting edges have stood up well where the pressure is constant, as in boring or turning. But where there is an intermittent cut as in milling or planing, the shock of the cutting edge striking the work has a bad effect on the plated edge. Chromium has a low co-efficient of friction and so makes a good bearing surface.

Application of X-Rays

The paper on the "Application of X-rays in the Automotive Industry," by George L. Clark, R. H. Aborn and Elmer W. Bruggman was one of the best expositions of the value of research that could be imagined. Prof. Clark gave an enthusiastic account of the many facts regarding materials that have been laid bare by the use of X-ray apparatus. He showed many examples as to how this method now gives us positive knowledge regarding the structure of materials of all kinds, from metals to rubber and asbestos, and the way in which the knowledge can be applied to the selection of proper materials for various purposes. While chemical analysis and microphotography have their place in ordering materials and in examining them, the X-ray is of much greater value as it tells exactly the characteristics that are necessary to secure the desired results.

Taking as an example a piece of sheet steel for drawing radiator shells, a microphotograph may show the condition of the surface but an X-ray will show whether the steel will draw or not. The method, of course, is to X-ray a sheet that gives satisfactory results and use the grain structure shown in this piece as a guide in selecting the proper material. The effect of alloys is clearly shown and Prof. Clark opened up so many possibilities as to the use of the X-ray as to be almost staggering to those who had not followed its practical application beyond teeth and broken bones.

While it is impossible to give even an outline of the phases of X-ray work covered by the paper, it may be well to note that it included the ultimate

structures of materials, the crystalline structure of pure metals and alloys, the effect of fabrication on cast metals, rolled and drawn metal, heat-treatment, welds, annealing, wearing qualities, etc. It also shows the constitution, structure and behavior of rubber, rubber fillers, asbestos, textiles, porcelain, lubricants, and paints and varnishes. It promises to give us definite information on subjects that have heretofore been mere conjective.

Myron A. Lee, of Cornell University outlined briefly the methods followed in teaching production principles, which was introduced by Dean Kimball in 1904. They aim to teach the fundamentals and let the student get the specific details later. The instruction includes machine design with sufficient data to apply to a specific machine. Then some mechanism, such as an automobile transmission is selected and the students plan for its production in given quantities. They select the kind and amount of machinery required, allot time and cost for each operation as a result of time study on similar operations, and plan a factory for the production of the mechanism. This planning includes the cost of power, space and other factors, all of which go to make up a grand total.

Lt. Thee, of Camp Holabird, urged that vocational training be placed on a higher plane. Lt. L. Cannel, of Ohio State University, outlined a method, while W. L. Carver spoke of the necessity of the sales, the engineering and the production departments of industry getting together and learning to look at the problems from a common viewpoint. All the speakers emphasized the value of the technical and trade papers in keeping abreast of the progress being made. John Younger, who presided at this session, pointed out the desirability of teaching not only present practice but the trend of developments so that students might be prepared as to what to expect when they got out into actual production work.

There were numerous other sessions dealing with research, body building, deterioration, light-cars, chassis and transmissions. The "Mystery Session" was of special interest when, under the guidance of Coker Clarkson, past presidents, H. W. Alden, B. B. Bachman, David Beecroft, H. M. Crane, H. L. Horning, J. H. Hunt, C. F. Kettering, T. J. Little, Jr., A. L. Riker, and J. B. Vincent spoke briefly on various phases of the automobile industry. The enthusiasm and co-operation displayed at these meetings reflected credit both on the industry and on the energy and efficiency of the general manager and his staff.

Stabilization of Money Values Presents New Problems to Industry in France

Brings opportunity to American machinery builders

BY OUR PARIS CORRESPONDENT

APPARENT stabilization of the franc has arrived. It now stands at about 25 to the dollar. Desirable as this may be manufacturing industries will feel, and are feeling, the effects both at home and in foreign trade. When the dollar stood at 40 francs it was not difficult to sell French automobiles, machinery of certain types, cast-iron pipe and aluminum sheets abroad; on the other hand it was then difficult for the American manufacturer to meet his expectations in the French market.

A four-hundred-dollar machine tool (leaving freight and customs' dues out of the question) would have been priced in France at least 16,000 francs—priced at that figure but probably unsaleable. With the changed situation of today that same machine at 10,000 francs might have a fighting chance.

This means a renewed competition in the French home market, which the French themselves naturally do not like; and it means also that they are handicapped in world markets for their export product to the extent of fifteen paper francs per dollar. In many lines this will mean a severe drawback.

This is the argument of big business in France against a too rapid revalorization of the franc and the stabilizing of it at too high a rate as based on the dollar.

Poincaré is now hampered since the first of January. He can do nothing without the assent of parliament. He has brought the franc back to 25 to the dollar, which is virtually where it was just a year ago. From now on it is a matter of readjustment on all sides, above all toward the lowering of living costs and making such provision as may be possible against unemployment. Both are pressing issues weighing heavily on present and future.

Just how far the improved value of the franc touches French industry is set forth by Senator Mario Roustan to the effect that the dollar at 30 francs touches the automobile industry; at 28 frances the textile industry feels it; at 26 frances the metallurgical industries are cramped.

As the dollar was quoted at 40 francs six months ago, and is now at a trifle more than 25, it is obvious that quite all elements of French industry using machinery as a replacement for hand labor must look to new methods and applications to keep the wheels of production turning. This ought to lead to a modernizing of French factories on even a greater scale than has been observed since the war.

The government has reduced the interest on short term borrowings from 3½ to 3 per cent, and the Bank of France in its balance sheet of the last week of December, announced a gold reserve in its vaults of 3,684 488,000 francs, with advances to the state of 36,000,000,000 francs (a decrease of 450,000,000 frances from the month before) and with a still outstanding note issue of 52,907,325,000 francs (an increase of 673,799,000 francs for the month).

Semi-raw metallurgical products have somewhat diminished as to base prices but nothing like the extent that the foreign exchange and general financial situations have readjusted themselves. The general industrial and labor situation is bound to go through an immediate, difficult and lengthy period of co-ordination.

AUTOMOBILE MERGER

The automobile industry has outlined a curtailed production program for the immediate future. There is rumor of a combination, or consortium, of French automobile manufacturers, after the plan of the General Motors Corporation, in which Peugeot, De Dion-Bouton, Bellanger and others may be concerned. The object is to bring about a limitation of models and give a better use of manufacturing and distributing facilities. The French army has recently ordered large fleets of motor trucks from the Latil firm, which is one example of a motor manufacturing firm working to capacity at the present time.

Electrical tools and machinery are finding normal trade currents both at home and abroad. There is little sign of slowing down here, still less of shutting down. There is talk of some sort of a trade combination in international electrical lines but nothing appears to have shaped itself to date.

The tool and machinery trades note a frank and great incertitude, foreseeing material sacrifices which will have to be made before normalcy is reached.

The railway rolling stock industry appears confident of a revival of better times owing to material needs of French railways, this being in direct contrast to the pessimistic complaints of the past few months because of a scarcity of orders and the fact that important proportions of what were forthcoming were given to Germany on the basis of war payment accounts.

The improved financial situation brought about by recent increases in freight and passenger rates, has permitted these companies to make more definite plans for renewal of equipment than would otherwise have been possible.

The Orleans railway line is still awaiting delivery on more than two hundred electric locomotives ordered for its 530 kilometres of electrified line. From this it would seem that manufacturing facilities in this line in France are not yet up to the demands which are being made upon them. The Nord Railway has gone to Belgium for twenty-five high-powered locomotives. The aviation industry is generally active and prosperous, important government orders being in prospect.

In view of possible unemployment during the expected readjustment period, the government is already taking steps to ease the situation. A certain effervescence is to be noted in communist circles, but the government assures the public that it will not be allowed to develop into a political situation and that the remedy to be

applied will be a practical rather than a theoretical one. The socialists have petitioned M. Poincaré for the immediate ratification of the Washington eight-hour day agreement.

With the new session of parliament, a project for the "intensification of national production" will be launched. This can only mean, with respect to certain basic industries, government participation or subvention in some form or other. A plan for the reconstruction of French trunk highways is under way, which will provide some demand for roadbuilding machinery.

The agricultural tool and machinery industry, which has grown abnormally in France since the war, is greatly concerned with the matter of production costs, foreseeing the necessity of larger production in the mass and wider distribution facilities if their product is to compete with that of America.

Meantime American and Canadian production are likely to hold their own though, of course, affected by exchange values, freight and customs' dues. The improvement of the franc to 25 to the dollar is helping the latter situation while adversely it is making it more difficult for the former. This being one of the comparatively new large scale industries in France, it may be looked upon as being one of the important key industries since it more or less directly concerns the eleven million farm population of France out of the total thirty-eight odd million inhabitants. Perhaps this will be the test block on which the new "intensive national production" theory will be worked out, since if such machinery can be more widely distributed and a greater freedom had from foreign servitude in this line, it will at least prove that France is less dependent on resources other than its own, than is commonly supposed.

A broad colonial policy is expected to ease up the situation for food stuffs, textiles and other items now bought from the foreigner. The general scheme which is some day to be set forth by the government is worth anticipating by all who have business relations with France. With the franc stabilized at 25, an increasing scale of customs dues, a reciprocal colonial policy, and government subvention to private industry conditions will be such that it will need something more than chain production of motor cars to prove that Mr. Ford's theory that production is everything and that sales will take care of themselves, as a formula which may be universally accepted and applied.

G. E. Orders Increase

Orders received by the General Electric Co. for the year ending Dec. 31, 1926, totaled $327,400,207, an increase of 8 per cent, or nearly $25,000,000, over 1925. This is the biggest volume of orders in the company's history, the previous high mark, achieved in 1920, being $318,470,000, or about ten millions below the new record.

For the fourth quarter of 1926, orders booked amounted to $90,406,570, compared with $78,636,669 for the last quarter in 1925, a gain of 2 per cent.

Metropolitan Engineers Organize to Aid Education

At an organization meeting, held on Jan. 22, of members of the Society for the Promotion of Engineering Education living in the Metropolitan Area, the formation of a section of the society to be known as the "New York and Northern New Jersey Section" was made an accomplished fact. Dean George B. Pegram, of Columbia University, was elected president, and Dean E. H. Rockwell of Rutgers, secretary. At the invitation of Dean A. M. Greene, the next meeting is to be held at Princeton. Director W. E. Wickenden discussed steps already taken toward the better co-ordination of engineering education. Discussion dealt with vocational guidance, and of the better utilization of the resources of the Metropolitan area in technical education.

Mid-West Power Show in Chicago

The success of last year's experiment in holding a Mid-West Power Show in Chicago has led to the preparation of plans for a more extensive exhibition this year. The dates of the show are Feb. 15, 16, 17 and 18, in the Coliseum in Chicago. This building will permit the convenient arrangement of a large and diversified exhibit of power machinery and allied material. At least 260 companies will participate.

The technical program has as its backbone the second annual Mid-West Power Conference, which has the cooperation of the leading engineering societies. This will draw together a notable group of power specialists and leading engineers in the many fields in which power is important. Those attending will hear lectures and discussions by widely known authorities, which will augment the value of the show itself. Excursions are scheduled which will throw open to visiting engineers the leading public service and manufacturing plants of Chicago.

Bethlehem Machinists Should Apply for Extra Wages

Thousands of former machine shop employees of the Bethlehem Steel Co., of Bethlehem, Pa., who have wages due them under an award of the National War Labor Board have failed to make application for the amount due from the War Department. Checks are being mailed at this time by the War Department for its share of the award, which amounts to 62.61 per cent of the total amount due them.

The award of the National War Labor Board covers time worked at the Bethlehem plant between Aug. 1, 1918, and Feb. 28, 1919.

Due to the length of time since the award was issued, thousands of the employees affected have moved to all parts of the country. A total of about 38,000 machine shop employees and those of other departments are affected by the award. Over half have not applied and the time limit for filing the claims with the War Department expires on March 4, 1927. The International Association of Machinists, Room 304 Perkin Building, Allentown, Pa., will be pleased to furnish claim forms and necessary information to any persons affected by the award who will send a request to the above address.

Armstrong-Whitworth Plan to Avoid Collapse

A moratorium has been established to save from receivership and to postpone at least for five years the disintegration of a company with $135,000,000 capital, namely, the Armstrong-Whitworth Co., one of Great Britain's foremost industrial organizations. As makers of arms and ammunition, that concern was one of the Allies' great dependencies. After the war the company strove to turn its enormously war-increased productive powers to activities of peace, so as not to deprive thousands of employees of their means of livelihood. In such side issues, however, losses were huge, and lately the point was reached when it was obvious that obligations could not be met.

According to the moratorium plan, for five years no interest or dividends will be paid, the interest coming due being held cumulative. Debenture holders also will be given certificates, and even the bankers will receive no interest for five years on their $15,000,000 loaned to the company. The board of directors also will be set aside for that period and the control of the company will be placed in the hands of an advisory committee.

Changes in Westinghouse Engineering Staffs

A complete reorganization of the engineering department, to obtain a better concentration of engineering personnel and facilities at the East Springfield Works of the Westinghouse Electric and Manufacturing Co., has been announced by W. S. Rugg, vice-president in charge of engineering.

C. H. Garcelon, formerly manager of the small motor engineering of the East Pittsburgh Works has been appointed manager of engineering of the East Springfield Works. C. A. M. Weber has been appointed manager of the small motor engineering department at the East Springfield Works. E. W. Denman has been made section head in charge of the fan motor section of the small motor engineering department. A. K. Phillippi will continue to act as resident engineer of the radio engineering department.

In the new plan of operation all fan motor and small motor engineering except that of farm lighter and locomotive headlighter work will be located at the East Springfield Works. The farm lighter and locomotive headlighter work will remain at East Pittsburgh.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THE action of the United States in unanimously declaring for arbitration in Mexico and the announced willingness of the United States, Great Britain and Japan to treat with the warring factions in China were in a larger sense the most important happenings chronicled last week. The first is a moral guarantee against war with our neighbor on the South, for which all men of good will are profoundly grateful, and the second indicates that unless some military blunder is committed the Chinese crisis probably is past.

But they were without any immediate effect upon the trend or tone of business, which continues to be satisfactory without being sensational. The voices of the prophets strike many notes of caution but the facts give back only few harmonizing echoes. Business has not regained and does not seem to be regaining the heights from which it dropped in the autumn, but in most lines it satisfies all but inflated desires and in some, as in dry goods, it has lately been very good indeed. If the word "normal" were more than a symbol, we might say that it described the present flow of goods from producer to consumer. Hand-to-mouth buying continues and appears to have been adopted as a permanent national institution. It does not promote enthusiasm but it employs less credit and enables merchants to avoid congestion and to distribute goods as they are wanted.

Speculation in all markets has been conspicuous by its absence, but a sharp decline last week in the shares of a corporation listed on the Curb Market caused the failure of a Philadelphia brokerage house, and on Tuesday the apathy that prevailed on the New York Stock Exchange was punctuated by a rather sharp decline in the more active stocks. The financial writers explained the drop by attributing it to a fit of the "blues" and one proclaimed that "professional Wall Street is plainly, frankly and outspokenly bearish on this stock market." But it has been my experience that the "blues" are an effect rather than a cause of price declines and the recuperative power shown disputes the assertion that professional sentiment is so unanimous.

The facts seem to be that a decline in industrial profits is rightly to be feared if too much of the expensive machinery of mass production is left idle because the inferior return received by the farmers reduces buying, and that the deferred hope of an advance is becoming wearisome to some of those who are carrying securities on margin. The ease of money is, however, likely to act as a shock absorber, and while a gradual settling of effervescent values may be in order, any serious drop will probably be cushioned by the investment demand, which still seems to be insatiable. Reflecting this, the bond market has been steady to firm. It is in order to point out that a conjunction of easy money and declining business profits might result in the stock and bond markets parting the company which they have kept during the past few years, and each going a different way, and most good judges seem to think that bonds, while high, are not dear. The statement of the Federal Reserve Banks issued last Thursday supports this diagnosis, for it reveals another gain, this time $30,000,000, in gold, a decline of $50,000,000 in bills discounted, and an increase in the reserve ratio, to 79.6 per cent, which is the highest since September 1924, and compares with 76.9 per cent the previous week and 75 per cent a year ago. Gold continues to arrive from France and the total of such shipments now exceeds $14,000,000. Her willingness to send it is courageous as well as encouraging.

Few important changes are to be chronicled in the commodity markets. The most important is the defeat of the bearish sentiment in wheat and its advance to more than 7 cents above the recent low. Other grains share its strength. Cotton is distinctly easier, for the active buying during the past three weeks has filled spinners' most urgent needs and doubt of the predicted decrease in next year's acreage persists while new crop contracts sell at 14 cents or better. Sugar has fluctuated within a narrower range but the strength of the statistical position is securing wider recognition and not many deny the probability of higher prices.

Steel business has improved somewhat, the trade reviews say, but at the expense of prices, for there are not enough orders to go around and producers are competing intensively. The aloofness of the automobile manufacturers is a matter of concern, but the condition of that industry could be described in almost the same language. Competition is so keen that the makers fear to accumulate stocks of cars and production schedules are still below normal for this time of the year.

Other indicators made available last week pointed to a volume of business not greatly different from that of a year ago, which ought to be considered entirely satisfactory.

The picture as thus presented is not exciting but neither is it disturbing and in its background of foreign news it is distinctly more cheerful. Nowhere does it suggest that those who are alert and industrious need feel any unusual fear for the future of business.

WHAT'S DOING IN INDUSTRY

FEBRUARY opens up with most manufacturers of and dealers in machinery and tools looking forward to a month of good business. The month just past ushered in a period of activity that was not wholly expected and in which actual orders placed were in excess of estimates. The current volume of inquiries assures a continuance of this activity in the next month.

NEW YORK reports a slight break in the upward sales trend, but inquiries are holding up well. Business is not up to expectations in Buffalo. In Philadelphia a satisfactory condition prevails, large industrialists furnishing a good part of present business. Orders for special machinery are keeping New England manufacturers busy.

CLEVELAND dealers state that orders are only fair, but that inquiries are better than at any time in the past three months. Further gains in sales in Detroit are attributed to betterment in the automotive industry. The sales curve in Cincinnati is unsteady, but the future is promising. A few large contracts for tools in Chicago have served to stabilize the market.

THE PICTURE of present business conditions is not exciting, but neither is it disturbing; and foreign news is distinctly more cheerful. Nowhere does it suggest that those who are alert and industrious need feel any unusual fear for the future of business.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW ENGLAND

The season of annual meetings is at hand in the New England section and the financial statements given to stockholders substantiate the earlier observations of executives on the business of the year. Final figures show comfortable profits. These, with statements of officials, are the basis for a satisfactory feeling prevailing.

Railroads were the best buyers during the past ten days period, and there has also been some substantial buying on the part of automotive manufacturers. Some of this buying has a flavor of being of the replacement variety. Better buying of small tools for export shipment has been observed.

Inquiry mail received by special machinery builders is indicative of a substantial volume of this business to be had. Connecticut manufacturers are booked ahead for this class of business.

DETROIT

Further gains in the sales of machinery and machine tools in Detroit and other automobile centers in Michigan are reported during the past week, bringing the total January business to a higher figure than many had expected.

The confidence which permeates the automotive industry has in turn been passed on to machinery dealers. During the Detroit automobile show a number of actual orders for new equipment were placed, and several sizeable lists sent out.

Signs of keener competition are forcing some of the local plants to revamp their lines, and already the replacement of obsolete machinery has started at Dodge, Chevrolet and Hudson plants. Ford remains quite inactive, but this condition may be changed at any time.

MILWAUKEE

The demand for metal working equipment continues rather quiet, although inquiry is improving steadily and the outlook is becoming more promising. The market still feels the effect of a slow demand from automobile shops, which are limiting their purchases to bare necessities of a replacement character. There are exceptions, however, in the case of two or three of the quantity producers who are still engaged in making extensions. The impression prevails that the volume of automobile busines may not reach the 1926 total, and tool shops that have depended to a considerable extent upon this source for business are busily engaged in developing other sources.

General industrial demand is fair, but so far in the new year it has not passed the stage of meeting strict needs. There are some large concerns that are adding to capacity, but in the main the effort appears to be toward supplanting obsolete equipment with the latest, high efficiency and rapid production types. This movement, obviously, is throwing back on the market considerable equipment that is usable but in no great demand because of limited purpose, and therefore not suitable for the average shop that prefers to buy second-hand machinery.

The principal Milwaukee machinery industries have been booking some orders within the last few weeks that are outstanding in character. The Allis-Chalmers Manufacturing Co. received a single order for miscellaneous equipment valued at $400,000, the largest individual booking in several months. The Harnischfeger Corporation has received orders for cranes aggregating $350,000 in value.

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that, while the business curve has been rising and falling from day to day in the past week, the aggregate volume of sales has been better than fair. Sales agents report that they more than held their own and expect a continuation of the upward market trend.

Several good orders were received during the week, one being from the Pullman company and another from a large manufacturer of conveyors. Railroads made a few purchases from lists that have been out for some time. Concerns in the automotive industries confined their purchases to single tools and replacements. The greater part of the week's buying was done by general machinists and miscellaneous industrial users.

Inquiries came in freely during the week, most of them being for single tools and replacements, but there were several lists included in the prospects. Inquiries coming from South America and Porto Rico are regarded as indicating better prospects and an increasing demand in these markets.

NEW YORK

The last few days in January and the early part of February brought a slight recession in activity in the machinery and machine tool market in this territory. Dealers and agents express the opinion that this is just one of the periodic breathing spells after an unusually active season.

Inquiries have not diminished, and their increased number leads to the general belief that this month will see the closing of some good business. The New York Central R.R. is inquiring for a list of toolroom equipment, and the General Electric Co. has not yet closed on the large list of machines needed for the new refrigerator plant. Orders were closed in the past week by the International Harvester Co., the Western Electric Co., the Royal Typewriter Co., and the Hartford Machine and Screw Co. The D. L. & W. and the Big Four railroads also purchased tools for repair shops.

PHILADELPHIA

The first four weeks of 1927 found conditions here in the machinery and machine tool industry in a satisfactory condition.

Some of the manufacturers said a slackening of the buying among automobile plants was noted but attributed it to a seasonal decline. They predicted the late winter months or early spring will bring a resumption of activity in the automotive trade.

General industrial establishments along the Atlantic seaboard have been in the Philadelphia market for power plant equipment. Inquiries indicate a continued favorable situation. Power plant equipment has been moving in a satisfactory manner, and machine tools for industrial establishments have found a market throughout the East.

Buying among railroads has been small. Some of the manufacturers specializing in equipment for railroads reported there have been some inquiries from which some orders may develop, but there is nothing assured. Machinery and machine tool plants and those producing similar equipment are operating from 50 to 80 per cent of capacity.

CLEVELAND

Local machinery and machine tool dealers have received a fair amount of business in the past fortnight. The activity that was prevalent the first two weeks of the new year has gradually subsided and a spotty condition is reported in some lines. Orders received were mostly for single tools for replacements. Sales in the last two weeks were made to iceless refrigeration, brass goods, electrical, rubber tire, wood working and tractor manufacturers.

Machinery men in several lines report an awakening of activity which seems to forecast better business for the next few months. There are more inquiries on hand at the present time than at any time in the last three months.

BUFFALO

The machine tool trade in Buffalo during January was spotty. Business did not start off with the energy that was expected of it, and only two or three dealers reported anything like the amount of business which it was expected the month would produce.

According to present conditions and the lack of current inquiries, the business for February and March in the general machine tool field looks somewhat dubious.

The one bright spot in this locality at the present time lies in the field of contractors' equipment. While this is the dull season in this field normally, the volume of business this month compares favorably with previous years and probably 50 per cent more highway equipment has been sold this season for snow removal than in any previous year.

CHICAGO

Following the closing of the lists of the Illinois Steel Co. and the Pullman Car and Manufacturing Co., several substantial contracts for tools were recently awarded to Chicago machinery houses. With the exception of these transactions, little activity has been noted in the machine tool market within the last week. What business is being done in this line is largely confined to sales of single tools or small lots, which have been just sufficient in number to remove the market from a state of comparative stagnation.

Inquiries coming in are of an encouraging nature, predicting a more active condition of business development during February. Local representatives of small tool manufacturers report that since the beginning of this year their sales have been of a satisfactory volume, and express the belief that as 1927 advances they will continue to increase.

Machine Tool Builders Announce All Space Taken for First Exposition

More than fulfilling earlier predictions of an assured wide interest among machine tool builders and accessories companies, the National Machine Tool Builders' Association announces that the entire area of the National Machine Tool Builders' Exposition, to be held in Cleveland Sept. 19 to 23, has been reserved, and that a waiting list of companies desirous of having display space has had to be made.

The exposition will occupy all of the new West Annex of the Public Auditorium in Cleveland. The building contains more than 100,000 sq.ft. of floor space, and was built to meet exacting exposition specifications.

The association announces that it is making an effort to obtain further space, so that it may accommodate the companies now included in the waiting list for space, and also such later applications for space as may appear. So far it has not been possible to make definite arrangements for an annex to the exposition, but it is hoped that within a short time it may be possible to announce the working out of plans for the accommodation of from fifty to one hundred additional exhibitors.

The following is a list of the firms which have reserved exhibition space.

Abrasive Machine Tool Co., Acme Machine Tool Co., Acme Machinery Co., Chas. G. Allen & Co., *American Machinist*, American Tool Works, Avey Drilling Machine Co.

Badger Tool Co., Baker Brothers, Barber-Coleman Co., Barnes Drill Co., W. F. & John Barnes Co., Charles M. Besley & Co., Blanchard Machine Co., J. G. Blount Co., Bowen Products Corporation, Bradford Machine Tool Co., Bridgeport Safety Emery Wheel Co., Brown & Sharpe Manufacturing Co., Bryant Chucking Grinder Co., Bullard Machine Tool Co.

Canadian Machinery and Manufacturing News, Carlton Machine Tool Co., Chicago Belting Co., Chicago Pipethread Machine Co., Cincinnati-Bickford Tool Co., Cincinnati Lathe and Tool Co., Cincinnati Milling Machine Co., Cincinnati Shaper Co., Cisco Machine Tool Co., Cleveland Automatic Machine Co., Cleveland Planer Co., Cleveland Punch and Shear Co., Cochrane-Bly Co., Columbia Machine Tool Co., Commercial Tool Co., Consolidated Machine Tool Co.

Detroit Machine Tool Co., Diamond Machine Co., Dreses Machine Tool Co.

Eastern Machine Screw Corporation, Ex-Cell-O Tool and Manufacturing Co.

Fairbanks-Morse & Co., Farrel Foundry and Machine Co., Fellows Gear Shaper Co., Flather Co., Foote-Burt Co., Fosdick Machine Tool Co., Foster Machine Co.

Gairing Tool Co., Inc., Gallmeyer & Livingston Co., Gardner Machine Co., General Electric Co., Geometric Tool Co., Giddings & Lewis Machine Tool Co., Gisholt Machine Co., Gits Brothers Manufacturing Co., Gleason Works, Goddard & Goddard Co., Gould & Eberhardt, Greenfield Tap and Die Corporation, Greenlee Brothers & Co.

Hanson-Whitney Machine Co., Heald Machine Co., Hendey Machine Co., High Speed Hammer Co., Inc., Hisey-Wolf Machine Co., Hoefer Manufacturing Co.

Ingersoll Milling Machine Co., International Machine Tool Co., *Iron Age*.

Jones & Lamson Machine Co.

Kearney & Trecker Co., Keller Mechanical Engineering Co., Kelly-Reamer Co., Kempsmith Manufacturing Co., Kent Machine Co., King Machine Tool Co., W. B. Knight Machinery Co.

Landis Machine Co., Landis Tool Co., J. N. Lapointe Co., R. K. LeBlond Machine Tool Co., Lees-Bradner Co., Lehmann Machine Co., Leland-Gifford Co., Lincoln Electric Co., Lodge & Shipley Machine Tool Co., Logansport Machine Co., Lucas Machine Tool Co.

Machine Products Co., *Machinery*, McCroskey Tool Corporation, Michigan Tool Co., Micro Machine Co., Moline Tool Co., Monarch Machine Tool Co., Murchey Machine and Tool Co.

National Acme Co., National Automatic Tool Co., National Machinery Co., New Britain Machine Co., Niagara Machine Tool Works, Niles Tool Works, Norma-Hoffman Bearings Corporation, Norton Co.

Oesterlein Machine Co., Ohio Machine Tool Co., Oilgear Co., Oliver Instrument Co.

Peerless Machine Co., Porter Cable Machine Co., Pratt & Whitney Co., Putnam Machine Co.,

Racine Tool and Machine Co., Ransom Manufacturing Co., Reed-Prentice Corporation, Rickert-Shafer Co., Rivett Lathe and Grinder Co., Rockford Drilling Machine Co., Rockford Machine Tool Co., Joseph T. Ryerson & Son, Inc.

William Sellers & Co., Inc., Sidney Machine Tool Co., S.K.F. Industries, Inc., Skinner Chuck Co., Smith & Mills Co., Springfield Machine Tool Co., Standard Tool Co., L. S. Starrett Co., Sunstrand Machine Tool Co.

Taylor & Fenn Co., Thompson Grinder Co., Timken Roller Bearing Co., Torrington Co.

Union Manufacturing Co., Union Twist Drill Co., Universal Boring Machine Co.

Van Dorn & Dutton Co., Van Norman Machine Tool Co.

Walcott Machine Co., O. S. Walker Co., Wardwell Manufacturing Co., Warner & Swasey Co., Westinghouse Electric and Manufacturing Co., J. H. Williams & Co., Williams, White & Co., Wilmarth & Morman, Wisconsin Electric Co.

Colonel Prout Dead

Colonel Henry G. Prout, for sixteen years editor of *Railway Age*, and active in railway engineering circles until his retirement in 1915, died at his home in Summit, N. J., on Jan. 26. He had been in ill health for several months.

Colonel Prout had a long and interesting career in railroad pioneering work, beginning as a surveyor for the Government in the Great Lakes and the Rocky Mountain regions. He later entered the military service and was one of the U. S. military engineers sent to Egypt in 1873 to assist that country in its domestic engineering problems. He was appointed Governor of the Equatorial Provinces.

When he returned to the United States he took up railroad engineering and was identified with the introduction and promotion of many signal devices. This association he continued even after he had entered the publishing field as the editor of the *Railroad Gazette*. He was later president and general manager of the Union Switch and Signal Co., and for a short time president of the Hall Switch and Signal Company.

His work as editor of *Railway Age*, which terminated in 1903, was characterized by the same forcefulness and energetic pursuit of results and accomplishments that he had shown in the engineering field.

Personals

N. C. Gove has been appointed sales manager of the L. C. Smith Bearings Co., of Chicago.

Matt J. Herold has resigned as sales manager for the United States Electrical Tool Co., of Cincinnati. He has been succeeded by George M. Lawrence.

H. A. Sparrow has been appointed manager of the new Detroit office of the Cleveland Worm and Gear Co. He will cover part of Michigan.

Alexander C. Shand, chief engineer of the Pennsylvania R.R., has been promoted to the position of assistant to the vice-president.

Charles L. Cameron has resigned as sales manager for Gould & Eberhardt, machine tool manufacturers, of Newark, N. J.

Walter E. Rahm, formerly chief engineer for the Burroughs Co., of Newark, N. J., has become sales manager for the Watson-Stillman Co., of New York.

Edward G. Meckstroth has been appointed general manager of the Morris Machine Tool Co., of Cincinnati. He was formerly with the Cincinnati Planer Co., of Cincinnati.

Thomas Butts has been appointed assistant to the chief of the industrial machinery division of the Department of Commerce. He was formerly sales representative in Europe for the Chicago Pneumatic Tool Co.

William J. Schaffer, formerly general foreman for the Hanson-Whitney Machine Co., of Hartford, Conn., has joined the sales department of the Triplex Machine Tool Co., of New York. He will cover the Connecticut territory for this firm.

Harry E. Miller has been appointed works manager of the Newark, N. J., plant of the Westinghouse Electric and Manufacturing Co. Mr. Miller has been in the employ of Westinghouse since 1889, starting in the machine and tool departments.

Edwin H. Peirce, of Worcester, Mass., has been appointed vice-president and general manager of the Niles Tool Works Co., Hamilton, Ohio, and will be assistant to James K. Cullen, president of the company. The Niles Tool Works Co. is a division of the Niles-Bement-Pond Co. Mr. Peirce is a graduate of Harvard, class of 1904. For the past nineteen years he has been active in the American Steel and Wire Co., of the United States Steel Corporation. For about six years he was superintendent of the New Haven Works of the company. For the past two years Mr. Peirce has been superintendent of the South Works, located in Worcester, Mass.

Business Items

The Westinghouse Air Spring Co., of New Haven, Conn., has been merged with the Cleveland Pneumatic Tool Co., of Cleveland. Both companies manufacture air controlled tools and springs.

The Toledo plant of the Bock Bearing Co. was sold at auction last week to representatives of the Monarch Machine Co., Philadelphia. The Bock Bearing business was sold to the Timken Roller Bearing Co., last year.

The Detroit Machine Tool Co. has discontinued the manufacture and sale of centerless grinders. Recent rumors to the effect that the Heim Grinder Co., or Cincinnati Grinders, Inc., had taken over the centerless grinder business of the Detroit company, are declared to be unfounded.

The American Brass Co. announces that arrangements have been completed whereby it will take over the manufacture and sale of "Everdur" metal from the Du Pont Everdur Co. This alloy is manufactured by the American Brass Co., in the form of casting ingots, plates, sheets, rods and wire, and is also available in the form of washers, bolts, nuts, screws, rivets, wire cloth and castings. The research work conducted by the Du Pont company in developing this metal will be continued by the American Brass Co.

Obituaries

GEORGE M. LANDERS, formerly vice-president, secretary and treasurer, and at present a director of Landers, Frary & Clark, manufacturers of hardware and cutlery, died at his home in New York on Jan. 26. Mr. Landers was at one time mayor of New Britain, Conn., and also served as president of the Connecticut State Senate.

CHARLES C. STUTZ, secretary of the American Institute of Weights and Measures, died suddenly at his home in New York City on Jan. 29. Mr. Stutz was a leading figure in the several legislative contests over the proposed adoption of a compulsory metric law, being on the side of the opponents of such a law. He was a member of the American Society of Mechanical Engineers and of the American Society of Electrical Engineers.

ANSON WOOD BURCHARD, vice-chairman of the board of directors and chairman of the executive committee of the General Electric Co., and chairman of the board of directors of the International General Electric Co., died on Jan. 22 of acute indigestion at the home of Mortimer L. Schiff, with whom he was lunching, in New York City. Mr. Burchard was graduated from Stevens Institute of Technology in 1885 with the degree of mechanical engineer. In 1902 he joined the organization of the General Electric Co. About a year ago he was relieved of the duties of president, but continued as chairman of the board. He was director of several utility and electrical companies, and a member of many electrical and power clubs and organizations.

Calendar of Local Meetings

A.S.M.E.

Hartford. Feb. 8. Hartford Electric Light Auditorium. "Fatigue of Metals," by H. F. Moore, University of Illinois.

Detroit. Feb. 16. Detroit Engineering Society. "Purchasing vs. Engineering," by E. T. Gushee, Detroit-Edison Co.

Newark. March 28. Down Town Club, Newark, N. J. Sectional meeting of the Machine Shop Practice Division. "Plant Maintenance," by G. H. Ashman, of the General Electric Co.

Society of Automotive Engineers

Pennsylvania Section. Feb. 8. "What Has Research to Do With Manufacturing," by J. H. Hunt.

Chicago Section. Feb. 8. "High-Speed Ignition Systems and Breaker Systems," by F. G. Shoemaker.

Washington Section. Feb. 10. "Rubber and Its Uses," by W. L. Holt.

Indiana Section. Feb. 10. "Trend of the Industry as Reflected by the New York Show," by T. J. Litle.

New England Section. Feb. 10. "The Electric Drive as a Motor Bus Transmission," by Charles Froesch.

Southern California Section. Feb. 11. Piston ring symposium.

Metropolitan Section. Feb. 17. "Buses," by R. N. Graham.

Detroit Section. Feb. 17. "Electro-Deposition of Rubber," by Dr. S. E. Sheppard and J. W. Schade.

National Association of Cost Accountants

Boston Chapter. Feb. 17. "Operating Costs and Radio in the Paper Industry and Methods of Determining Them," by Clyde Morgan.

Buffalo Chapter. Feb. 24. "Distribution of Selling Expense by Class of Product and Territories," by Albert E. Grover; and "Essential Records for Management," by George Frampton.

Chicago Chapter. Feb. 17. "Application of Factory Expense in Standard Costs," by Prof. David Himmelblau.

Cleveland Chapter. Feb. 16. "Should Interest on Investment be Included in Cost," by U. F. Von Rosen.

Detroit Chapter. Feb. 24. "Cost Accounting as a Basis for Shaping Operating Policy," by A. W. Bass.

Erie Chapter. Feb. 21. "Problems of Departmental Cost," by C. R. Stevenson.

Hawaii Chapter. Feb. 21. "Mercantile Accounting," by C. P. Benton.

Hartford Chapter. Feb. 15. Debate on subjects of mutual interest between purchasing agents and cost accountants.

Kansas City Chamber. Feb. 21. "Predetermined vs. Actual Costs in Loss and Gain Statement."

Los Angeles Chapter. Feb. 15. "Taxes (Income), Other Taxes and Their Distribution to Costs."

Milwaukee Chapter. Feb. 17. "Important Points on the Federal and State Income Tax Laws," by L. A. Lecher.

Philadelphia Chapter. Feb. 18. "Some Faults of Present Cost Systems."

Pittsburgh Chapter. Feb. 16. "Executive Budgets," by Herbert A. Gidney.

Providence Chapter. Feb. 14. "That the Least Important Function of Industrial Accounting Is the Determination of Costs for the Setting of Selling Prices," by W. H. Segar.

Rochester Chapter. Feb. 16. "Accounting for Capital Assets," by Kenneth Richmond.

St. Louis Chapter. Feb. 15. "Relation of Costs to Bank Credits," by H. F. Boettler.

San Francisco Chapter. Feb. 28. "The Determination, Classification and Distribution of Administrative and Selling Costs."

Scranton Chapter. Feb. 15. "Federal Taxation," by D. W. Phillips.

Springfield Chapter. Feb. 16. "Distribution of Selling and Arministrative Costs," by F. L. Sweetser.

Syracuse Chapter. Feb. 15. "Specific Applications of Standard Cost," by A. Ross Burley.

Twin Cities Chapter. Feb. 15. "Business Management of the Minneapolis School System," by Geo. F. Womrath; and "How-We-Do-It in Banks," by Charles H. Preston.

Utica Chapter. Feb. 21. "Cost of Distribution or Selling, and Administrative Costs," by L. E. Vannais.

Forthcoming Meetings

American Management Association. Winter convention, Hotel Pennsylvania, New York, Feb. 15 and 16. W. J. Donald, secretary, 20 Vesey St., New York.

American Railway Association. Engineering Division, March 8 to 10, at Chicago; Mechanical Division, June 7 to 10, at Montreal; Purchases and Stores Division, date and place not yet announced. H. J. Forster, secretary, 30 Vesey St., New York City.

American Society for Testing Materials. Spring group meetings of standing committees, at Philadelphia, March 15 to 18. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Society of Mechanical Engineers. Regional meeting, Kansas City, Mo., April 4 to 6. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

National Association of Purchasing Agents. Annual meeting and "Informashow" at Grand Rapids, Mich., June 6 to 9. W. L. Chandler, secretary, Woolworth Bldg., New York City.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association,** and the **American Supply and Machinery Manufacturers' Association,** on board the steamship *Noronic.* Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia.

American Society for Testing Materials. Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

American Railway Tool Foremen's Association. Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

National Machine Tool Builders' Association. First exposition of machine tools at Public Hall, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, chairman of the exposition committee. Roberts Everett, manager, 1328 Broadway, New York City.

The Weekly Price Guide

Rise and Fall of the Market

FINISHED steel prices show the effect of the recent weakness in the pig-iron market. Demand is receding with consequent sharpening of competition for available tonnages. Steel sheets and strips show particularly marked recessions. The automotive industry is the only one to show actual increase in steel requirements for the last week. Dullness pervades the non-ferrous metals market, with the possible exception of antimony and zinc. Steel bars and shapes now sell at a range of $1.90@$2 per 100 lb., Pittsburgh mill, against the recent flat rate of $2. Plates hold none too steadily at the old level of $1.90 per 100 lb. f.o.b. mill.

(All prices as of Jan. 27)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$22.19
Northern Basic	20.89
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	28.17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20@2.30	3.50	3.25	3.89
No. 12	2.25@2.35	3.55	3.30	3.94
No. 14	2.30@2.40	3.60	3.35	3.99
No. 16	2.40@2.50	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.70@2.80	3.75	3.60	4.15
No. 22	2.85@2.95	3.90	3.75	4.30
No. 24	2.90@3.00	3.95	3.80	4.35
No. 26	3.00@3.10	4.05	3.90	4.45
No. 28	3.15@3.25	4.20	4.05	4.60
Galvanized				
No. 10	3.05@3.15	4.10	3.95	4.40
Nos. 12 to 14	3.15@3.25	4.20	4.05	4.50
No. 16	3.25@3.35	4.30	4.15	4.60
No. 18	3.40@3.50	4.45	4.30	4.75
No. 20	3.55@3.65	4.60	4.45	4.90
No. 22	3.60@3.70	4.65	4.50	4.95
No. 24	3.75@3.85	4.80	4.65	5.10
No. 26	4.00@4.10	5.05	4.90	5.35
No. 28	4.25@4.35	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	226
4	1.09	4.5	4.026	237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — B.W.G. and Decimal	Fractions	Outside Diameter in Inches — ¼	⅜	½	¾	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	4.50	6.00@7.50	4.65
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@½-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.62½
Tin, 5-ton lots, New York			67.00
Lead (up to carlots) E. St. Louis	7.20	New York	8.00
Zinc (up to carlots) E. St. Louis	6.50	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese) ton spot	16.50	16.50	15.00
Copper sheets, base	21.75	21.75	21.75
Copper wire, base	18.75	18.75	15.37½
Copper bars, base	21.37½	21.37½	21.37½
Copper tubing, base	23.75	23.75	23.75
Brass sheets, high, base	18.12½	18.12½	18.12½
Brass tubing, high, base	23.00	23.00	22.50
Brass rods, high, base	15.87½	15.87½	15.87½
Brass wire, high, base	18.62½	18.75	18.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	26.00	27.00	26.02
Zinc sheets (casks)	13.00	12 30	11.36
Solder (½ and ½), (case lots)	40.75	43.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	86.00
Commercial genuine, intermediate grade	61.50
Anti-friction metal, general service	32.50
No. 4 babbitt (f.o.b.)	13 50

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35 00	Electrolytic	39.00	Shot	36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.37½@11.62½	11.00	10.25@10.75
Copper, heavy, and wire	10.62½@11.12½	11.25	9.50@10.00
Copper, light, and bottoms	9 25 @ 9.50	9.50	8.50@ 9.00
Heavy lead	6 25 @ 6.62½	6.25	5.50@ 6 00
Tea lead	4.50 @ 4.75	4.25	4.50@ 5.00
Brass, heavy, yellow	7.00 @ 7.25	7.25	6.50@ 7.00
Brass, heavy, red	9.00 @ 9.25	9.25	8.50@ 9.00
Brass, light	5.25 @ 5.75	5.75	5.75@ 6.25
No. 1 yellow rod turnings	7.50 @ 7.75	7.50	7.00@ 7.50
Zinc	4.00 @ 4.25	4.00	3.00@ 3.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9 50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0. 13@0. 17½	$0.16	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.13	.12@ 17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 175 lb. keg	2.80	2.75	2.75
Roll sulphur, per lb	04	03½	04
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.84½	.98	87
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.55	50	.50
Machine oil, medium-bodied (55 gal. metal bbl.), per gal.	.33	.35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb	.1587½	.1637½	.1687½
Solder (½ and ½)	per lb.	.4075	.41	.3975
Cotton waste	per lb.	.13@17½	13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7 00	7 00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	33	35	35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5. 84	$5.13
Emery paper	10. 71	11. 00	10. 71
Emery cloth	27.84	31. 12	27. 84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1 32	1. 45	1. 32
Cloth	3.10	3. 50	3.05
Fire clay, per 100 lb. bag		.75	75
Coke, prompt furnace, per net ton		Connellsville,	3.50@4.00
Coke, prompt foundry, per net ton		Connellsville,	4.50@5.50
White lead, dry or in oil,	100 lb. kegs	New York,	15.25
Red lead, dry,	100 lb. kegs	New York,	15.25
Red lead, in oil,	100 lb. kegs	New York,	16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{3}{16}$-in and smaller and 65% for ¼-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%

Rivets, button heads, ¾-in., ½-in., 1-in. diam. x2$\frac{7}{16}$-in to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ½-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Equipment Wanted

Ill., Chicago—Chicago Steel Foundry Co., Kedzie Ave. and 37th St.—small hammer forge, board drop hammer and 72 in. vertical boring mill.

Mass., Boston—American Steam Gage & Valve Mfg. Co., 80 Federal St.—additional machinery and equipment for plant addition on Camden St.

Mass., Boston—Merchants Tire Co. Inc., 74 Huntington Ave.—miscellaneous tools and equipment for proposed 95 x 110 ft. auto service building and repair shop, at Jersey and Boylston Sts. Estimated cost $75,000.

Mass., New Bedford—Tourists Garage, 125 Middle St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $50,000.

Mo., Kansas City—Diamond State Fibre Co., 501 Kemper Bldg.—miscellaneous tools and equipment for proposed plant for fabricating and cutting gears.

Mo., Kansas City—Turner-Warner Screw Co., 1226 Lydia Ave.—machinery and tools including screw machines of various sizes.

Mo., Nevada—Missouri Pacific R.R. Co., Railway Exchange Bldg., St. Louis, W. A. Hopkins, Purch. Agt.—miscellaneous tools and equipment for proposed machine shop here.

N. Y., Buffalo—Satuloff Bros., 176 Michigan Ave.—machinery and equipment for proposed 3 story, 150 x 200 ft. garage and repair shop. Estimated cost $150,000.

O., Canton—Bd. of Education, A. E. Welsbacher, Dir., will receive bids until Feb. 14 for machine tools and equipment for shops for Lincoln high school.

O., Columbus—Columbus Auto Parts Co., 215 East Russell St., R. D. Klages, Purch. Agt.—machinery to equip a new plant on Mock Rd. to be completed about Apr. 1.

O., Delaware—Delaware Chair Co. (furniture)—complete equipment for addition to factory now under construction.

O., Salem—The Electric Furnace Co.—one 20 in. American lathe with 10 ft. bed, and one set plate bending rolls, capacity ½ in. plate, 6 ft. wide.

Pa., Johnstown—Bethlehem Steel Corp.—100 ton ladle crane.

W. Va., Parkersburg—Parkersburg Rig & Reel Co.—10 ton overhead traveling crane, 60 ft. span.

Wis., Fond du Lac — Morris Bros., 20 East Sibley St.—equipment for foundry being remodeled. Estimated cost $40,000.

Alta., Drumheller—Pepper Bros. Ltd.—electric welder, generator or transformer type and 75 ton forcing press.

Ont., Galt—Galt Foundry Co., Beverley St.—machinery and equipment for proposed foundry. Estimated cost $10,000.

Que., Montreal—Darling Bros., Ltd., 120 Prince St.—complete equipment for foundry to replace fire loss.

Opportunities for Future Business

Ark., Hawes—Dierks Lumber & Coal Co., 700 Gates Bldg., Kansas City, Mo., will build a saw mill, machine shop, etc., here, by day labor. Estimated cost $500,000. Private plans.

Calif., Los Angeles—Mesick & Mahy Mfg. Co., 1431 South Wall St., (silversmiths) is having preliminary plans prepared for the construction of a 3 story industrial building. Estimated cost $40,000. J. J. Frauenfelder, 1116 Story Bldg., Archt.

Calif., San Francisco — H. Fleischaker, et al, awarded contract for the construction of a 2 story garage at Van Ness Ave. and Market St. Estimated cost $150,000.

Conn., New London—Broad Street Auto Co., S. M. Sulman, 8 Shapley St., had plans prepared for the construction of a 1 story, 120 x 175 ft. garage on Broad St. Estimated cost $100,000. F. DeGange, 60 Ocean Ave., Archt.

Conn., Westport — L. Gault, Riverside Ave., will receive bids until Feb. 11 for the construction of a 3 story, 75 x 150 ft. garage. Estimated cost $125,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archt.

D. C., Washington—Emerson & Orme, 1620 M. St., N. W., will soon award contract for the construction of a garage at 17th and M. Sts. N. W. Estimated cost $300,000. A. P. Clark, Jr., 811 14th St., N. W., Archt.

Ill., Chicago—G. E. Holmes, 30 East Lake St., plans the construction of a 14 story, 80 x 161 ft. garage at Lake and Dearborn Sts. Estimated cost $2,000,000. S. N. Crowen, 22 West Monroe St., Archt.

Ill., Chicago—B. Mittelman, 11 South La Salle St., awarded contract for the construction of a 3 story, 103 x 215 ft. garage at 2425 North Clark St. Estimated cost $250,000.

Ind., Hammond—Harter Industrial Dist., C. Retz, Mgr., awarded contract for the construction of a 1 story, 150 x 350 ft. factory. Estimated cost $150,000. Anderson & Valle Stamping Co., lessee.

Ind., Hammond — Rimbach Estate awarded contract for the construction of a machine shop and garage on Sibley St. Estimated cost $42,000. M. Turner, Hohman St., Archt.

Ind., Indianapolis—Library Realty Co., State Saving & Trust Bldg., is receiving bids for the construction of a 1 story, 62 x 160 ft. machine shop and service building. Estimated cost $40,000. Vonnegut, Bohn & Mueller, Ind. Trust Bldg., Archts. Reo Auto Co., 927 North Meriden St., lessee.

Ind., Indianapolis — Universal Brass Works, H. Meyer, Pres., 29th and Martindale Sts., awarded contract for the construction of a 1 story, 102 x 163 ft. foundry at 139 South East St. Estimated cost $43,000.

Kan., Chanute—Bd. of Education, is having plans prepared for the construction of a 2 story, 100 x 150 ft. and 56 x 87 ft. additions to junior and senior high schools including 68 x 106 ft. shop buildings, etc. Thomas W. Williamson & Co., 312 Central National Bank Bldg., Topeka, Archts.

Md., Baltimore—Neill Buick Co., Maryland and Mt. Royal Aves., had plans prepared for the construction of a 3 story service station at Sisson and 26th St. Estimated cost $100,000. Charles M. Anderson, 9 East Pleasant St., archt.

Mass., Boston—North Station Garage Co., F. G. Barrows, 40 Central St., awarded contract for the construction of a 6 story garage at Causeway, Beverly and Haverhill Sts.

Mass., Somerville (Boston P. O.) — H. Bernstein, 11 Beacon St., Boston, is receiving bids for the construction of a 1 story, 90 x 220 ft. repair and service garage on Medford St., here. Estimated cost $75,000. R. Testa, 224 Hanover St., Boston, Archt.

Mass., Waltham (Boston P. O.)—J. L. Thompson Mfg. Co., J. L. Thompson, Pres., Roberts Station, rivet manufacturers, is having preliminary plans prepared for the construction of a 2 story addition to factory. Estimated cost $50,000. A. F. Gray, 53 State St., Boston, Archt.

Mass., Watertown (Boston P. O.)—Kiernan Duffy, 15 Hunnewell Ave., Brighton, is receiving bids for the construction of a 1 story auto repair shop on North Beacon St. here. Estimated cost $40,000. Desmond & Lord, 1 Beacon St., Boston, Archts.

Mich., Detroit—Cew Center Development Corp., Fisher & Co., General Motors Bldg., is having plans prepared for the construction of a 10 story garage in connection with 25 story theatre and office building, etc. Estimated total cost $30,000,000. A. Kahn, 1000 Marquette Bldg., Archt.

Minn., Minneapolis — Dale Bros., 1204 East Lake St., will soon receive bids for the construction of a 3 story garage at 11th and East Lake Sts. Estimated cost $50,000. P. E. Crosier, 915 New York Life Bldg., Archt.

Mo., Kansas City—Pague Mfg. Co., 29th St. and Southwest Blvd., manufacturers of tin cans, plans the construction of a 1 story 129 x 157 ft. factory at 57th and Summit Sts. Private plans.

Mo., St. Louis—I. Weinberg, 816 Chestnut St., awarded contract for the construction of a 3 story, 60 x 224 ft. garage at 3656 Washington Blvd.

N. J., Kearny — Western Electric Co. plans the construction of a 6 story, 60 x 300 ft. addition to plant.

O., Canton—Hal-Fur Truck Co., A. C. Fuhrman, V. Pres., 1783 East 21st St., plans the construction of a 1 story factory. Estimated cost $50,000. Architect not selected.

O., Cincinnati — Cleveland, Cincinnati, Chicago & St. Louis Ry. Co., 230 East 9th St., awarded contract for the construction of a 1 story machine shop on Hillside St. Estimated cost $40,000. H. Baldwin, Ch. Engr.

O., Cleveland—The Gas Products Co., S. D. Winger, V. Pres. and Gen. Mgr., Columbus, has acquired a site and plans the construction of a factory at Jannings Rd. and Baltimore & Ohio R.R. tracks, here.

O., Marion—Wilson Bohannon Co., manufacturers of locks and other hardware supplies, will receive bids until Feb. 7 for the construction of a factory.

Okla., Tulsa — Washington & Kelly, awarded contract for the construction of a 4 story, 100 x 140 ft. garage. Estimated cost $127,000.

Pa., Philadelphia—Stanley Construction Co., Lincoln Bldg., awarded contract for the construction of a 1 story, 80 x 240 ft. garage at Leiper St. and Frankford Ave. Noted Dec. 30.

Tenn., Knoxville—Dooley-Gillespie Co., Dedrick Bldg., plans the construction of a 3 story, 140 x 140 ft. garage at Hill and State Sts. Estimated cost $150,000. Bauman & Bauman, Market St. Archts. and Engrs.

Tenn., Memphis—D. Dermon, Bank Commercial Bldg., awarded contract for the construction of a 1 story garage at Monroe Ave. and South Wellington St. Estimated cost $50,000.

Tex., San Antonio — T. T. Parker, 226 Bushnell St., has acquired a site and plans the construction of a 2 story garage at Soledad and Augusta Sts. Estimated cost $65,000.

Vt., Rutland — Bardwell Hotel, N. J. Nicklaw, Mgr., is having sketches made for the construction of a 1 story garage and repair shop. Estimated cost $40,000. A. H. Smith, Gryphon Bldg., Archt.

W. Va., Parkersburg—Parkersburg Rig & Reel Co., awarded contract for the construction of a 1 story, 125 x 242 ft. factory. Estimated cost $100,000.

Wis., Racine—Racine Universal Motor Co., Bridge and Ontario Sts., is having plans prepared for the construction of a 2 story, 62 x 250 ft. factory on Goold St. Estimated cost $60,000. J. M. Matson, Baker Blk, Archt.

Ont., Toronto—Link-Belt Ltd., 265 Wellington St. W., is having plans prepared for the construction of a 1 and 2 story factory on Eastern Ave. Estimated cost $150,000 to $200,000. Ewart, Armer & Byam, 36 Toronto St., Archts.